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ON SOME ENTOMOSTRACA OF LAKE MICHIGAN AND ADJACENT WATERS.

BY S. A. FORBES.

ONE cannot go far in the study of the system of organic life which prevails in a stream or lake, without being made aware of the important part played therein by the neglected but interesting group of the smaller crustaceans. They occupy a central position not only in the classification of aquatic animals, but also in the complicated network of physiological relations by which the living forms of a body of water are held together as an organized society. Feeding, themselves, upon the lowest and smallest of plants and animals, they furnish food in turn to a great variety of the higher animals, and even to some plants.[1]

The fisherman who toils at his nets, the sportsman in pursuit of health and recreation, rarely reflect, even if they know, that their amusements and their labors depend strictly upon these humble creatures, of whose very existence, indeed, many of them are unaware; and yet there is ample evidence that, with few and unimportant exceptions, all young fishes, of our fresh waters at least, live for a time almost wholly upon entomostraca.[2] If de-

[1] In ten "bladders" of *Utricularia vulgaris*, taken at random, I found ninety-three animals, either entire or in recognizable fragments, and representing at least twenty-eight species. Seventy-six of the animals found were Entomostraca, and belonged to twenty species. Nearly three-fourths of both individuals and species were Cladocera. Just one-third of all the animals found in these bladders belonged to the single species *Acroperus leucocephalus* Koch.

[2] On the Food of Young Fishes. By S. A. Forbes. Illinois State Laboratory of Natural History, Bulletin No. 3, November, 1880, pp. 66–79.

On the First Food of the Whitefish. By S. A. Forbes, Normal, Ill. The *American Field*, Vol. XVII, No. 11, p. 171, March 11, 1882.

prived of this resource for the nourishment of their young, fishes would be reduced to an insignificant remnant of their present numbers.

Immense quantities of them are also taken by adult fishes, especially in early spring, and some of the largest species make them a principal dependence. The shovel fish (Polyodon) of our great central rivers—a giant among inland fishes—engulfs untold myriads of them at a meal—thus performing in fresh water the functions of the whale in the great seas. In the lakes of Europe they are the main food resource of several deep water salmonoids, while in our own great lakes, clouds of the higher crustaceans (Mysis) live wholly at their expense; and these Mysidæ, again, contribute largely to the maintenance of the whitefish and black-fin, and other important species. Some insect larvæ likewise prey upon them; and amphipod crustaceans, while they seem to feed chiefly upon vegetable structures of one sort or another, certainly sometimes attack and devour entomostraca with a surprising ferocity. Mollusca, one would say, could afford to be indifferent to them, since they neither eat them nor are eaten by them, nor seem to come in contact with them anywhere, through any of their habits or necessities. But for this very reason these two classes afford an excellent illustration of the stringent system of reactions by which an assemblage of even the most diverse and seemingly independent organisms is held together. To say nothing of the fact that both groups feed to a considerable extent upon the same kinds of food, and thus probably limit each other's multiplication, in some degree, the further fact that vast quantities of both are destroyed by fishes, brings them into a mutually hostile relation. If there were no entomostraca for young fishes to eat, there would be very few fishes indeed to feed upon mollusca, and that class would flourish almost without restraint; while, on the other hand, if there were no mollusca for the support of adult fishes, entomostraca would be relieved from a considerable part of the drain upon their numbers, and would multiply accordingly.

It is through their intervention that fishes and certain carnivorous plants are brought into apparent competition. The number of entomostraca and minute insect larvæ destroyed by the bladder-wort in some situations where the plant fills acres of the water, must be prodigious, taking the season through; and it

is not impossible that the food supply of young fishes is sometimes thereby materially diminished.

In short, it would be difficult to mention a single group of aquatic or semi-aquatic animals or plants, whose interests are not affected, immediately or remotely, by these little animals.

But they have other claims upon our attention besides their importance in the general system of aquatic life. To the student of classification, they offer a fresh and inviting field of original work; the physiologist and the histologist may examine here the animal organs and tissues reduced almost to their lowest and simplest terms, and yet easily studied in detail, while they still form living parts of living organisms; and those attracted by natural beauty (as who is not?) will find few lovelier objects for the microscope, or more admirable illustrations of the play of life than these exquisite, crystalline specks, each comprising within its minute anatomy a system of organs and structures which for complexity and for perfection of detail, would scarcely discredit a butterfly or a fish.

I know of but one contribution to an exact knowledge of the Entomostraca of Lake Michigan—a brief paper by Professor E. A. Birge, containing a list of nine species of Cladocera found in the Chicago water supply,[1] with a description of *Latona setifera* O. F. M.; and I have seen nothing upon those of any other of the great lakes, except the notes on a few Cladocera published by Professor S. I. Smith in his paper on the invertebrate animals of Lake Superior.[2]

On the smaller crustacea of the region adjacent to the lakes, we have the valuable " Notes on Cladocera,"[3] by Professor Birge, and a paper by the writer on the Crustacea of Illinois.[4]

The lake material upon which the present paper is based, was obtained chiefly by the towing-net and dredge in Grand Traverse

[1] Notes on Crustacea in Chicago Water Supply, with remarks on the Formation of the Carapace. By E. A. Birge, Professor of Zoology, University of Wisconsin, Madison, Wis. The Chicago *Medical Journal and Examiner*, Vol. XIV, No. 6, Dec., 1881, pp. 584–590, Pl. I and II.

[2] Sketch of the Invertebrate Fauna of Lake Superior. By Sidney I. Smith, United States Commissioner of Fish and Fisheries. Part II. Report of the Commissioner for 1872 and 1873, pp. 690–707.

[3] Transactions of the Wisconsin Academy of Sciences, Arts and Letters, Vol. IV, 1876–77, Madison, Wis., 1879, pp. 77–110, and Pl. I and II.

[4] Bulletin of the Illinois Museum of Natural History, No. I, December, 1876, pp. 3–25, and Pl. I.

bay, in the north-eastern part of Lake Michigan, and in the south end of the lake off Chicago and Racine. Several of the lacustrine species had been previously received from Mr. B. W. Thomas and Mr. Chas. S. Fellows, of Chicago, by whom they had been strained from the Chicago water supply.

A few additional species from the lakes and pools of Central and Northern Illinois, are described in the appendix to this paper, one of which occurs also in Southern Massachusetts, and probably throughout the country intervening.

One of the most interesting species was obtained in considerable numbers in Grand Traverse bay, associated with the ordinary forms of the lake, nearly all of which were abundant there in October, 1881. It is a copepod of the family Calanidæ, representing a new genus and species, for which the name *Epischura lacustris* is proposed (Pl. IX Fig. 8, and Pl. VIII Figs. 15, 16, 21–23 and 25–27).

The family is easily distinguished from Cyclopidæ and Harpactidæ, to which most of our other fresh-water species belong, by the elongate anterior antennæ of 23–25 articles, by the (usually) two-branched antennulæ and mandibular palpi, by the wide difference in size between the abdomen and thorax, and by the fact that in the male only one antenna is converted into a clasping organ. Epischura is colorless in autumn, although possibly red in spring, .063 in. long by .015 in. wide, and distinguished in both sexes by what seems at first a deformity of the abdomen. On closer inspection it is seen that in the male the last three segments of this region are laterally produced into a grasping organ of peculiar construction, and that the whole abdomen is thus distorted and rendered unsymmetrical. The lateral processes of the first and second segments evidently act against each other as a powerful pair of nippers, while the third, bearing upon the same side a stout toothed plate, must greatly increase the security of the grasp, when brought into play by the strong muscles of the abdomen. A fourth process extending forward from near the base of the right ramus of the furca, also contributes to the formation of this organ. A steel-trap attachment to the tail of an alligator would very well illustrate the vigorous embrace of this little crustacean. Besides this, the right antenna is thickened and hinged as a clasper, and the last pair of legs is also converted into a complicated apparatus of claws and forceps. In the adult

female the abdomen is usually bent outward to the left, to leave space for a finger-like process which arises at the hind end of the ovisac and curves upward beside the second segment. This is the spermatophore, the neck of which is firmly cemented to the under side of the abdomen. In this sex the legs of the fifth pair are extremely simple and rather small. They are not branched like the other legs, and are without the delicate and beautiful fringes of feathery hairs with which the swimming appendages are provided, but each consists of a single flat, three-jointed plate, with five spreading spines at and near its tip. The swimming legs of both male and female are peculiar in the fact that the inner branch of all the pairs is reduced to a single joint. The affinities of this genus are with Heterocope Sars, found in the lakes of Scandinavia, Switzerland and Upper Italy, and probably in other parts of Europe also; but the modification of the abdomen as a prehensile organ is a new idea among Copepoda. Mutilated specimens of the female of this species have been taken by Mr. Thomas from the water supply of Chicago; I also found the species common in Geneva lake, in Southern Wisconsin, in October, 1881.

Another beautiful member of this family, occurring abundantly everywhere in the lake and at all seasons of the year, is closely related to the *Diaptomus gracilis* of Europe; but a careful study of it during successive seasons, and a comparison with the original description of Sars and with the descriptions and plates of *D. gracilis* published by Gruber in 1878, have satisfied me that our species is distinct, and I therefore propose for it the name of *Diaptomus sicilis* (Pl. VIII, Figs. 9 and 20). It is the most slender and elegant of our Calanidæ, usually colorless and transparent, but sometimes crimson in spring. The antennæ are long and weak, reaching beyond the tip of the abdomen, and are provided with hairs of unusual length, that on the ninth joint, for example, reaching beyond the fourteenth. It is in the fifth pair of the legs of both male and female that we find the best distinguishing characters in this family—and here the clearest distinctions from *Diaptomus gracilis* occur. In the male both pairs are two-branched. The last joint of the right leg forms a slender, sickle-shaped hook, which is regularly curved from base to apex, while the outer branch of the left leg of this pair is two-jointed, with a pubescent, rounded extremity, bearing two short diverging claws.

EXPLANATION OF PLATE VIII.

FIG. 1.—Diaptomus sanguineus, ♀, × 42.
" 2.—Dorsal outline of the same.
" 3.—Diaptomus sanguineus, ♂, geniculate antenna, × 50.
" 4.— " " ♂, right leg of fifth pair, × 67.
" 5.— " " ♂, left " " × 70.
" 6.— " " ♀, leg of fifth pair.
" 7.— " " second maxilliped, × 63.
" 8.— " stagnalis, antennula, × 48.
" 9.— " sicilis, ♂ fifth pair of legs, × 160.
" 10.— " stagnalis, ♂, fifth pair of legs, × 48.
" 11.— " " ♂, geniculate antenna, × 22.
" 12.— " " ♂, left antenna, × 22.
" 13.— " sanguineus, mandible, × 160.
" 14.— " stagnalis, ♀, leg of fifth pair, × 86.
" 15.—Epischura lacustris, ♀, fifth pair of legs, × 88.
" 16.— " " ♀, side view of abdomen, × 17.
" 17.—Diaptomus leptopus, ♀, leg of fifth pair, × 66.
" 18.— " " ♂, right leg of fifth pair, × 66.
" 19.— " " ♂, left " " × 66.
" 20.— " sicilis, ♀, fifth pair of legs, × 160.
" 21.—Epischura lacustris, mandible and palpus.
" 22.— " " blade of mandible.
" 23.— " " ♀, abdomen and furca from above, × 48.
" 24.—Osphranticum labronectum, first maxilliped, × 180.
" 25.—Epischura lacustris, ♂, fifth pair of legs, 70.
" 26.— " " second maxilliped, × 88.
" 27.— " " leg of first pair, × 70.
" 28.—Osphranticum labronectum, ♀, leg of fifth pair, × 70.
" 29.— " " ♂, fifth pair of legs, × 70.

(To be continued.)

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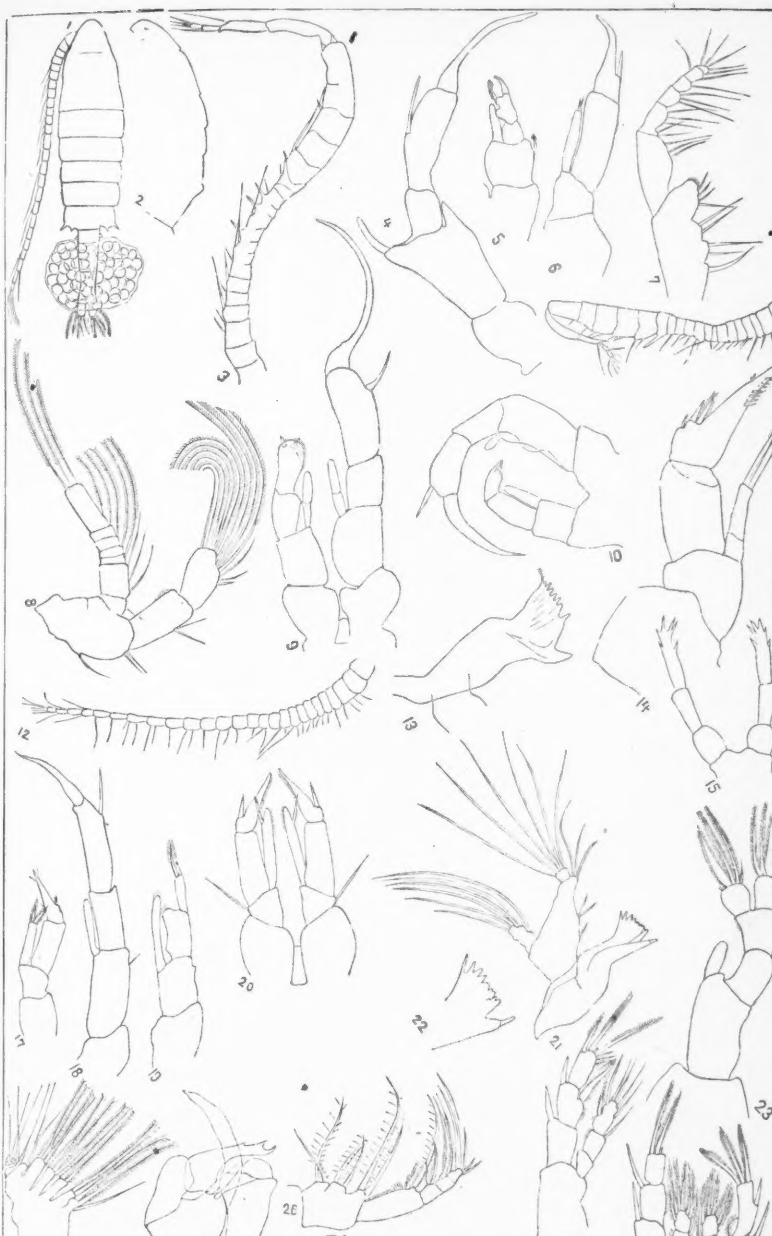
THE LOESS OF NORTH AMERICA.

BY R. ELLSWORTH CALL.

(Continued from May number.)

Physical Geography of the Loess Era.—The Champlain epoch, to which the loess belongs, was characterized by general continental depression, which lessened the area of the land and increased the average temperature. Such a depression was followed by extensive encroachment of the sea and its arms upon the land, the effects of which would be greatest in the great central basin of the continent. Hence there was a backing up of all the streams and a general sluggishness or complete loss of their currents in the lower portions of their valleys. At their sources extensive denudation was in progress, and the material thus derived

PLATE VIII.



was borne downward to the still portions below, and here the burden of the waters was cast as a blanket over their bottoms. The continued recession of the glaciers by dissolution kept the supply of water constant, or often swelled it to floods, thus permitting extensive denudations over large areas. "Below the falls of the Missouri the channel makes its way through the soft yielding clays and sands of the Cretaceous beds for about 250 miles" (Hayden). These beds extend nearly to the mouth of the Milk river, and then begin the Tertiary lignite formations, which are also here composed of sands, marls and clays. For another 250 miles the Missouri flows through rocks of this age, and then the Cretaceous slates again appear, which, according to Hayden, extend nearly to Council Bluffs, a distance of over 500 miles in a straight line. Now the amount of denudation possible to be accomplished by so large a stream, and in some of the most rapid portions of its ancient and present course, cannot be estimated, and especially is it needless to hazard any conjecture when we consider the character of the formations it traversed for a distance much exceeding 1000 miles! It is entirely adequate to form deposits many times greater than the whole extent of the loess in America. Into the ancient Lake Missouri, then, was poured the drainage of a vast area, and over a tenth of Iowa and a fourth of Nebraska the sediment it contained was deposited.

To another cause than the depression of the continent[1] must the great extent of the Missouri valley loess be attributed, and that cause was the narrowing of the valley south of St Joseph, acting as a barrier to the waters which then were spread out into lake-like proportions. With the gradual disintegration of its barrier and the recession of the sea consequent on the reëlevation of the land, the lake was gradually drained, leaving its former silt-covered bed as the surface soil—a waste of mud and lakelets in place of the former broad expanse of water. The changes in level and aspect keep pace each with the other. Soon the desert waste abounds with a rich vegetation, the soil is clothed with grass and flowers, and the forests begin anew to grow. But the rivers were not idle. A period of erosion began—not yet ended—by means of which the great streams plowed them channels to

[1] The estimates of the totality of this depression vary from 200 to 500 feet, any of which would be sufficient to extend the gulf line northward as far, at least, as the mouth of the Ohio.

the sea through sediment of their own deposition. Ten thousand rills and rivulets from the adjacent hills, aided by wind, by storm, by rain, by frost, began the sculpturing of the landscape anew until the beauteous arrangement of hill and dale appears, and which gives the loess regions their peculiar topographical features.

Bibliography.—The literature of the loess is scattered through many volumes, a great majority of which are not easy of access to the general reader. The following list will be found to be nearly or quite as perfect, at least, as opportunity has permitted. It is believed to embrace nearly all yet written on this subject:

AUGHEY, SAMUEL.—*The Superficial Deposits of Nebraska.* Ann. Rept. U. S. Geol. and Geog. Surv. of Colorado and adjacent territory (1874). pp. 243–269.

Contains a general account of the surface geology of Nebraska. Those portions relating to the loess (pp. 245–255) contains the following sub-sections: "The Loess Deposits," recording certain geographical, physical and chemical facts, the last illustrated by five tables of analyses of loess soil. "Cause of these Peculiarities," treating especially of the action of carbonic acid and water. The next section treats of "Fruit on the Loess Deposits," and is followed by one on the "Scenery of the Loess Deposits." Then follows a discussion of the "Origin of the Loess Deposits," in which the aqueous theory is advocated with numerous confirmatory facts. This section is followed by one on the "Length of the Loess Age," and one on its life. The article closes, pp. 266–269, with a provisional list of the mollusks of the lacustrine deposits, in which mention is made of 124 forms. Attention has been elsewhere[1] called to this list which appears in the "Sketches" mentioned below without modification.

AUGHEY, SAMUEL, Ph.D.—*Sketches of the Physical Geography and Geology of Nebraska* (1880). 8vo, pp. 326.

Contains a complete and valuable account of the loess of Nebraska. Discusses the theories relating to its origin, the argument being mainly directed against the views of Von Richthofen. Gives list of life remains, and mentions the finding of human relics. Concludes that the Nebraska loess is of lacustrine origin. An expansion of the previous article.

BLAKE, W. P.—*Geology of the 35th Parallel,* in Vol. III Pacific R. R. Reports. Pt. IV, pp. 11 and 22 (1856).

Notices of the loess in the valley of the Mississippi, and along both sides of the Arkansas as far as Little Rock. Names certain fossils which are, however, European. Notices also a similar deposit on the Red river above Ft. Washita. At this latter point is noted the occurrence of Lymnæa, Physa, Planorbis, Pupa and Helix. The same author, in Vol. II of the same series, repeats substantially the same matter.

BROADHEAD, G. C.—*Origin of the Loess.* Am. Journal of Sci. and Arts, Vol. XVII (1879), pp. 427–428.

Concludes Von Richthofen's hypothesis inapplicable to the loess of the Mississippi

[1] AM. NAT., Vol. XV, p. 585.

and Missouri rivers. Mentions localities of evident *stratification*. Material supposed to be derived mainly from the Tertiary and Cretacean rocks of the Upper Missouri. Considers the deposit lacustrine.

CALL, R. ELLSWORTH.—*Geology and Natural History of Fremont Co., Iowa* (1880). pp. 35. (Extracted from history of Fremont Co., Iowa.)

Mentions distribution and physical features of the loess in this portion of Iowa, and the physical geography of the loess era. The article partakes entirely of the character of a popular treatment of the surface geology of the county.

CALL, R. ELLSWORTH.—*Fossils of the Iowa Loess.* Am. Nat., Vol. XV, pp. 585–586 (1881).

Notices the distribution of the loess in Southwestern Iowa. Calls attention to the number of species of fossils as mentioned by various observers. Lists of fossil land and fresh-water shells found in the counties of Mills and Fremont.

CALL, R. ELLSWORTH.—*The Loess in Central Iowa.* Am. Nat., Vol. XV, pp. 782–784 (1881).

Records the discovery of loess in Central Iowa, over large areas adjacent to the Des Moines river. A section accompanies, exhibiting the relation of the loess at Des Moines to other geological horizons. Lists fossils found.

DANA, JAMES D.—*Manual of Geology.* 2d edition, pp. 547–548 (1876).

General description of the alluvian deposits of the Champlain period. Notes only the loess of the Southern States, quoting Hilgard and Safford. Lists a number of fresh-water fossil shells from the loess of the Mississippi, but no mention is made of land forms, which alone are listed by both Hilgard and Wailes.

D[ANA] J. D.—Review of "*The Loess of the Rhine and Danube*," by Thomas Belt, F.G.S. Am. Jour. of Sci. and Arts, Vol. XIII, pp. 383–384 (1877).

A brief review of the principal conclusions reached by Mr. Belt with reference to the Rhine and Danube deposits, in the light of the geology of Eastern North America. Controverts the conclusion that various sub-glacial streams were dammed by ice to produce the terraces along the valley of the Rhine, in Europe, and that of the St. Lawrence, in Canada. Contains little on the general subject of this paper.

D[ANA] J. D.—Review of "*China, by Ferdinand Freiherrn von Richthofen.*" Am. Jour. of Sci. and Arts, Vol. XIV, pp. 487–491 (1877).

Contains an elaborate review of the first volume of this great work, the review being largely devoted to a statement of Von Richthofen's subaërial hypothesis of the origin of the loess. Gives all the salient features of the theory, together with the principal arguments relied upon as proof. Quotes the author's objections to Kingsmill's theory of marine submergence, as well as those advanced to Pumpelly's former view of fresh-water origin. The reviewer presents no theory of his own.

HAYDEN, DR. F. V.—*First Annual Report of the U. S. Geol. Survey of the Territories*, pp. 10, 12, 18–19, 45 (1867).

Contains a brief historical and geographical account of the loess in Nebraska. Notices of distinct stratification in certain localities. Remarks on the adaptability of the loess for vine culture.

HAYDEN, DR. F. V.—*U. S. Geol. Surv. of Wyoming and Contiguous Territory*, pp. 98–99 (1870).

Notices the terraces at the city of Omaha, and indicates the probable physical

geography of the region at the time of their formation. Considers the loess to be an estuary or lacustrine deposit. The occurrence of Molluscan and Mammalian forms is noted. Herein (p. 99) occurs the first mention of Unio in the loess, "in the banks of some of the little streams."

HAYDEN, DR. F. V.—*Final Report on Nebraska.* H. R. Ex. Doc. No. 19. Part I. Geology, pp. 3–79 (1871).

Brief remarks on the loess in various parts of the report. Sometimes called yellow marl or bluff deposit. Great fertility and productiveness of the soil of Nebraska attributed to this deposit.

HILGARD, E. W.—*Agriculture and Geology of Mississippi,* pp. 194–197, and many references in agricultural report (1860).

Professor Hilgard herein gives a complete physical and chemical description of the loess. Its range in the State is minutely described, and its fossils are indicated, which, as he remarks, are exclusively terrestrial forms. This list is taken from Wailes' Report, with the addition of two forms. The mammalian remains stand as reported on by Professor Wailes six years previously. The author records the observation of "definite marks of stratification."

HILGARD, E. W.—*The Loess of the Mississippi Valley and the Æolian Hypothesis.* Am. Jour. of Sci. and Arts, Vol. XVIII, pp. 106–112 (1879).

This paper is the most elaborate review of Richthofen's hypothesis which has come under notice. The author states that it was not his "intention, at this time, to discuss exhaustively the question of the origin of the loess in general, but rather to formulate some of the more prominent objections lying against the application of the æolian hypothesis to some of the loess regions with which a long study has made me familiar." The author then proceeds to state Richthofen's objections, and to array certain facts in refutation. Certain structural peculiarities illustrative of aqueous action are adduced; and these are in turn succeeded by full notes of chemical peculiarities. Summing up the evidence the author concludes, "the sum total of anomalous conditions required to sustain the æolian hypothesis, partakes strongly of the marvelous."

H. H. HOWORTH.—*Traces of a Great Glacial Flood.* Geological Magazine, Jan., Feb., 1882.

MCGEE, W. J.—*Superficial Deposits in Northeastern Iowa.* Proc. Am. Asso. for the Adv. of Sci., Vol. XXVII, 1878.

This author frequently mentions a "loess-like clay" of very variable thickness in this portion of Iowa. Reference is made to its physical characters which seem to be precisely similar to those of true loess. Its marked peculiarities as a topographical feature is noted, and likewise the fact of its occurrence on hills relatively higher than those surrounding. Its relation to the subjacent drift proper is quite marked, but it often grades insensibly into the drift; its origin is referred to glacial action.

MCGEE, W. J.—*The Surface Geology of a part of the Mississippi Valley.* In the Geological Magazine, August, 1879. pp. 354–356.

Herein are given more fully the loess features of Northeastern Iowa, than in the article last cited. The formation is here characterized as "a whitish-yellow, loess-like clay, unstratified, free from gravel, sand and boulders." The author notes absence of stratification "except where it has been rearranged by fluviatile agencies." Numerous peculiar and anomalous features of distribution are noted; it was found

sometimes to cover the summits of kames. It formed the upper surface of hills and ridges rising forty or fifty or even more feet above the general level, over which the same materials were never deposited.

NEWBERRY, J. S.—*On the Surface Geology of the Great Lakes and the Valley of the Mississippi.* Annals of the Lyceum of Nat. Hist. of New York, Vol. IX, pp. 213–234 (1869); also in Am. Nat., Vol. IV, p. 193 (1871).

This paper is a general discussion of the surface geology of the central portions of the United States, "bounded on the north by the Eozoic highland of Canada, on the east by the Adirondacks and Alleghanies, and on the west by the Rocky mountains." The portion—a small one—relating to the loess is to be found near the close of the article. The author describes it as "a lacustrine, non-glacial, drift deposit." Its distribution is noticed, and the manner of its deposition.

OWEN, DAVID DALE.—*Report of a Geological Survey of Wisconsin, Iowa and Minnesota, and incidentally of a portion of Nebraska Territory* (1852).

Pages 132–133 and 135–136 of this valuable report contain some of the earliest published data with reference to the loess deposits of Iowa and Missouri. The remarkable contour of the hills bordering the valley of the Missouri is noted; and, though the occurrence of both land and fresh-water shells is mentioned, only land and semi-aquatic forms are indicated, as follows: *Helix thyroides, H. alternata, H. monodon, Helicina occularia* (quere *occulta*), *Succinea campestris?* and *Pupa armifera.* The generally accepted theory of lacustrine origin is alluded to, and an illustration of "hills of silicious marl, below Council Bluffs" is given. On p. 135 the same formation as it occurs at St. Joseph, in Missouri, is noted, and the same fossils are quoted with the addition of *Helix fraterna.* Dr. Owen considered these deposits and those of the Wabash equivalent.

OWEN, DAVID DALE.—*Geological Survey of Kentucky*, pp. 17–22, 27–29 (1856).

The author mentions "frequently recurring beds" of "very fine silico-calcareous earth of pale reddish-gray or ashen flesh tint." He states that the calcareous matter is derived in great measure from the land and fresh-water shells disseminated through the formation. The following genera are indicated: Helix, Helicina, Cyclostoma, Succinea, Pupa, Cyclas, Planorbis and Lymnæa. In accounting for the calcareous concretions, found in considerable abundance, Owen says they are "formed by the percolation of water charged with carbonic acid, which, dissolving the calcareous matter in the upper part of the deposit, carries it by filtration to the lower part of the bed, re-depositing it in the form of hard masses." He gives a description of the physical geography at the period when these beds were formed.

PUMPELLY, R.—*The Relation of Secular Rock-disintegratiom to Loess, Glacial Drift and Rock Basins.* Am. Jour. of Sci. and Arts, Vol. XVII, pp. 133–144 (1879).

This paper was originally read before the National Academy of Sciences. April 10, 1878. It opens with a general notice of the features of the loess, and makes especial reference to its lithological character. In this paper he abandons the view formerly presented in his "Geological Researches in Mongolia," &c., and says the formerly received theories "required inconceivable conditions and are full of contradictions!" Accepts fully Von Richthofen's hypothesis of subaërial origin. The paper is a very suggestive one, but however applicable to China fails in America.

SAFFORD, JAMES M.—*Geology of Tennessee*, pp. 114 and 433–434 (1869).

Gives a general account of the loess of West Tennessee. Remarks that it is dis-

tinctly stratified. Gives a list of six species of land and four species of fresh-water shells, found fossil in the loess of that State.

SMITH, DR. E. A.—*Outline of the Geology of Alabama.* (From Berney's Handbook of Alabama.) No date. pp. 67–68.

A brief mention only of the loess and the theory of Von Richthofen. Urges as an objection to its subaërial deposition the existence only, in Alabama, of the loess on the "immediate banks of streams." Mentions Tuomey's identification of the loess on the Lower Tombigbee and Alabama.

SWALLOW, G C.—*Second Annual Report of the Geological Survey of Missouri*, pp. 69–76 (1855).

This report contains one of the earliest and best descriptions of the loess of Missouri. Swallow gave it the name of "Bluff Formation" (p. 74), which term he employs throughout the volume. The origin is considered as lacustrine. In an appendix, p. 215, is given a catalogue of fossils, all determined by that eminent palæontologist, the late F. B. Meek. Chemical analyses are given, which have been elsewhere alluded to.

TODD, J. E.—*Richthofen's Theory of the Loess, in the light of the Deposits of the Missouri.* Proc. A. A. A. S., Vol. XXVII (1879). Read Aug., 1878. Also author's edition, pp. 10.

A very full and valuable criticism of the subaërial hypothesis. Considers separately the four principal points made by Richthofen. Contains valuable lists of fossils, and some novel observations on the depth to which roots penetrate the soil of the loess. This portion of the *brochure* is very valuable. The author concludes: "Even now we probably express the opinion of many students of the loess when we say that the subaërial theory has received attention and consideration, mainly because of the boldness and novelty of its conception, and the high rank and well-deserved reputation of its author, rather than on account of its real merits."

WAILES, B. L. C.—*Agriculture and Geology of Mississippi.* First Report, pp. 213–214 (1854).

Gives geographical distribution of the loess in Mississippi. Statement made that below the highlands of Arkansas, the formation is not met with on the western side of the Mississippi river. States that the fossils found are all terrestrial, and lists nine forms. (This is the list quoted by Hilgard.) Mastodon remains also noted.

WHITE, DR. C. A.—*Geology of Iowa.* Vol. I (1870), pp. 103–117, and numerous references in the sections devoted to county and regional geology.

The boundaries of the Missouri river loess are described, together with its general and chemical characters. The physical properties of the loess herein receive the most complete treatment yet accorded them. Dr. White concludes that "the deposit was formed as sediment in a fresh-water lake." Believes the material of the loess to have been derived from the Cretaceous and Tertiary strata of the Upper Missouri—"the most friable formations on the continent." In the Chemical Report, by Rush Emery, occur analyses of soil—those used in table preceding.

WITTER, F. M.—*History of Muscatine County, Iowa.* (The chapter, only, on Geographic and Geologic Features.) pp. 330–332. (187–).

This is extracted from a work of the above title, the date of the publication of which does not accompany the *brochure*. It contains a general account of the loess of

Southeastern Iowa, its distribution, aspects, fossils and deposition. The author accepts the theory of lacustrine origin.

WITTER, F. M.—*Notes on the Loess.* From the Muscatine Tribune (1879).

This is the title of a paper read before the Muscatine Academy of Science, February 10, 1879. It contains a general discussion of the Iowa loess, with incidental references to the same deposit in Nebraska and Missouri. Lists fossils from various localities in Iowa. "Entire absence of the families of Unionidæ and Viviparidæ in the loess" of various parts of the State is noted and commented on. Concludes in favor of the aqueous origin.[1]

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ORGANIC PHYSICS.

BY CHARLES MORRIS.

(Continued from June number.)

IN the life history of the Metazoa, or many-celled animals, the products of cell division enter into a new relation. Instead of the new cells existing as separate, they exist as united individuals. But there is nothing to show that they otherwise differ in any essential respect from the results of Protozoan division. The germ still separates into its constituents, which become more and more polarly diverse, until a vast mass of new cells is produced, in which those with male excess of vigor are just equal to those with female excess.

But in this development of a matured body from its germ, several interesting features appear, which we must successively consider. The first of these is the separation of the body into two bilaterally similar halves, a result which, although partly or completely masked in the lowest classes of the Metazoa, is very distinctly declared in the higher classes. Under our hypothesis this separation of the body into two similar halves has a special significance. The two halves of the body are polarly distinct, being respectively male and female in chemical constitution, so that the body of the offspring represents that of both its parents.

This conclusion seems to necessarily arise. If the simplest animal cell be a polar organization, with acid and basic, or male and female poles, then its division is a sexual separation. If the two new cells continued to cohere, they would form a bilaterally

[1] In connection with these references information of much value and direct bearing may be found in an article by Professor J. D. Whitney on "The Chinese Loess Puzzle" in AM. NAT., Vol. XI, pp. 705–713, in which the author inclines to the subaërial hypothesis. See also the reports of the geological surveys of Illinois, Ohio, Indiana and Michigan.

symmetrical organism, with a male and female side. Such may be the result of division of the germ of the higher animal. Produced by the union of male and female cells, and thus being sexually balanced, its first step of division is into two cellular halves, respectively male and female in their excess energies. Each of these continues to divide, and we can, with some show of reason, believe that each is the foundation of a separate development, which results in two complete organisms, intimately connected across their median line, yet polarly distinct.

Such is a not illogical deduction. The male and female constituents being polarly separated in the germ, and in the primary results of its division, might naturally continue polarly separated in the ultimate results of its division. The mature body consists of two halves, answering organ for organ, and so intimately connected by communicating nerves that practically no separation exists. The lateral halves of the body are as like and as intimately combined as were the lateral halves of the germinal cell, and the mature state is only a complete unfoldment of conditions which existed undeveloped in the germ.[1]

Had we space, several significant facts might be brought in illustration of this idea. The character of these illustrative facts may be briefly described. The frequent difference in degree of development of the two sides of the body, is indicative of differences of vigor in the germinal poles, the male or the female pole having an excess of energy. Certain malformations of the body are strongly indicative of such a relation of its opposite halves. In that form of malformation in which clefts or fissures appear, this takes place invariably in the median line of the body. What is called hare-lip is one such case of fissure, but many diverse cases have been observed, and they are all of one general character, a lack of continuity in the median line of the body, as if its two halves had failed to fully unite. In another kind of malformation, in which lack of development produces coalescence of organs, this always takes place across the median line. Thus cases are known in which the two eyes were merged into one, and others in which the lower part of the face was so undeveloped

[1] Each half of the body is, in fact, under the direct control of the other half, since the nerve center of each half is connected with, not its own organs, but those of the other half. This peculiar relation between the nerve centers and the lateral halves of the body is a fact of considerable significance in this connection.

that the two ears became conjoined. Similar coalescence has affected the viscera and the lower part of the body, but there is no instance of a coalescence that has not equally affected both sides.

In malformations in which some part of the body is abnormally developed, the rule is the same, the abnormality always extends across the median line. It is very rare that there appears any marked excess or deficiency of one side that is not shared by the other, and we know of no case of such lateral excess or deficiency sufficiently marked to be considered a monstrosity, though slight differences are of very usual occurrence.

There is another abnormality of great significance in this connection, that of hermaphroditism. In every case of true hermaphroditism in the higher animals, the male and female organs of generation occur on opposite sides of the body. This is not usually the case in the normally hermaphroditic animals, in which the two organs are often combined in a single gland, but so far as it goes it is an indication of sexual difference of the two halves of the body.

And such a conception aids us in comprehending the results of hermaphroditic generation. For if the two sides of the body are thus related, germs coming from opposite sides might be capable of proliferation, and thus unisexual generation be a normal process.

In the development of plants there does not, at first sight, seem to be any trace of bilateral division. And yet if we consider that the active layer of plants is a cylindrical tissue, bounded internally and externally by the most vital layers of the wood, we may surmise that the polar halves of the plant consist of its internal and external active layers, between which flows the nutrient fluid, in a cylindrical vascular tissue. This idea is sustained by the position of the hermaphroditic organs of the plant, the female organ always being central and the male organs disposed in a circle around it.

Evidently, under such a sexual law as that here proposed, there might be great differences in the sexual energy, and also in the life energy of new individuals. Where the polar energies of the germ were weak, the life energy would be reduced. And the degree of sexual differentiation would depend upon the excess of energy of one sexual pole over the other. Strength or weakness

of special tissues might result from the same cause, an excess or lack of polar energy in the chemical constituents of the germ which give rise to these tissues.

We have so far considered protoplasm as consisting of molecules of similar chemical constitution, and differing only in acid or basic energy. But in the protoplasm of the higher animals a special chemical differentiation takes place. The molecules of the unit of each tissue have a special chemical constitution of their own, which differs from that of any other tissue.

The simplest organisms have, in all their parts, identical relations with the environment. But as development goes on, this identity of relations ceases to exist. Fixed duties are assigned to fixed parts of the body, until finally every region of the organism has its definite office to fulfill. Chemical variation necessarily accompanies this functional variation. The special duties given to special tissues are chemical duties, or motor duties dependant upon chemical action. For their proper performance each tissue must have a special chemical constitution. Such a chemical divergence is a necessary result of divergent relations with the environment. In the higher animals all the internal tissues are removed from contact with external conditions. Their environment is the nutrient fluid. But this differs in different parts of its course. Certain organs take certain elements from it. More internal organs must employ as nutriment other material for which they may have a less vigorous affinity. But this assimilation of varied nutriment produces a divergence in chemical constitution, so that each tissue finally accepts from choice what it first may have accepted from necessity. This process of differentiation has gone steadily on, from the first to the last step of organic development, every change in the environment of a tissue producing a change in its chemical organization.

If such be the case we should look upon functional variation not as causing but as caused by chemical specialization. Many circumstances, having that undetermined origin which is called chance, may produce variations in the relations of the tissues to the external or the internal environment. In consequence, their chemical character changes. As a secondary result of this change their organic function varies. A new and perhaps more diverse relation is established between the parts of the organism in consequence of specializations in its chemical constitution, arising

from specialized relations with the environment. By a continuance of this process all functional differentiation is produced. Thus organic development is primarily chemical specialization.

One necessary result springs from this form of differentiation. Unspecialized cells may exist independently. All specialized cells must be coherent. They owe their existence to conditions produced by the action of other cells, and therefore can only exist in intimate connection with those cells. Thus chemical specialization is necessarily followed by cellular coherence, and the production of many-celled organisms. It is the basic cause of all life evolution beyond the Protozoan.

The considerations here taken render necessary certain underlying laws of organic evolution. Variation in the environment necessitates chemical specialization, followed by coherence of cells and functional differentiation. But a yet more primary principle lies at the basis of evolution. If the simplest life form depends for its vital energy upon chemical polarity, then an essential step to evolution must be some means of increasing the vigor of this polarity. Organic forms may have begun in colloid units with very feeble polar differentiation. If so, the first step in the evolution process must have been an increase of this differentiation, so as to increase the growth vigor and the power of germinal reproduction, or cell division. The tendency of such units is to neutralization, through chemical satisfaction. Oxidation overcomes this tendency by reproducing the original polarity. May not oxidation do more than this, and in some cases yield an increased polarity? If so, organic evolution resolves itself into this. Primarily the life energy of organisms grows greater and greater, as continued oxidation yields a slowly increasing vigor of chemical polarity. Secondarily the life energy becomes more diverse as successively new relations with the environment arise, and new chemical specializations in consequence. As oxidation produces the one, activity aids the other, the active organism varying its relations much more rapidly than the passive one.

If such be the chemical character of the mature organism, what is most probably the chemical character of the germ from which it arises? If in the process of growth only chemical agencies are active, and only chemical results produced; if chemical affinity is alone concerned in the two processes of physical growth and organic differentiation, then the germ can need none

but chemical powers, and all the physical actualities of the body must exist as chemical possibilities in its germ. The germ must represent, not physically but chemically, the fully developed organism.

If such be the case the molecules of the germ must be adapted to develop, by chemical assimilation, not only into every tissue of the body, but into every special portion of every tissue. Every region must be potentially present in the germ, each molecule of which must have its special polarities, and be adapted to a special mode of development.

Molecules are not produced by a "fortuitous concourse of atoms." Complex molecules are built up by successive steps of synthesis, and the mode of arrangement of the atoms is more important than their numbers and kinds. Even slight changes in this particular may cause marked changes in the physical character of the molecule.

The energies of the molecule are solely those of affinity. Two molecules of different formation differ in their chemical polarities, and their relations with exterior matter depend strictly upon the character of these polarities. Oxygen and hydrogen atoms unite to form a polar molecule of water. A number of water molecules combine with carbon to form a polar molecule of starch or sugar. This may in some way combine with ammonia to form a nitrogenized molecule. And so, perhaps by many steps of synthesis, the most complex molecule is finally attained. But in the formation of the final and of every intermediate molecule, an undeviating chemical principle must be obeyed. Each must be composed of acid and basic, or positive and negative constituents, and thus be a chemically polar organism. Thus it will be polar not only as a final compound, but each of its constituent molecules, down to the lowest of all, will also be a polar compound. And each minor polarity in the mass will retain its special character intact, and must manifest its peculiar affinities should it be set free by disintegration.

Instead of considering the polarities of constituent molecules, we may approach the subject from another direction. An organic being, a man for instance, is a vast mass of chemical molecules, aggregated primarily into cells, and secondarily into variously divergent tissues. The physical characters of these tissues depend on the chemical affinities and polarities of the cells com-

posing them, and these again upon those of their molecules. A greatly dwarfed being would have the same organization but must be composed of a vastly decreased number of cells and molecules. Yet dwarfing might continue until a very minute being resulted, so greatly reduced in size that the tissues would be represented by cells only. In such a case specialization would have become generalization, the cells which replace the tissues being adapted to reproduce these tissues if growth again take place. But if the dwarfing process still continue, the cells must disappear, and the nuclear bases of the cells, or minute groups of the nuclear molecules, replace them. But such nuclei, or groups of molecules would probably aggregate to the formation of cells of heterogeneous instead of homogeneous molecular constitution. Such seems a probable result of a continued dwarfing of a mature being. It begins with an aggregation of diverse and homogeneous tissues, specially arranged. It yields, if continued far enough, an aggregation of homogeneous cells, representing in character and arrangement the tissues. If continued still farther it yields an aggregation of heterogeneous cells, whose molecules represent in character and arrangement the homogeneous cells above mentioned. Each such cell would be a potential representative of a group of tissues. But if the dwarfing process be still continued, these generalized cells must also be reduced to groups of molecules, which would aggregate to form fewer and still more generalized cells. And a final completion of the dwarfing process would be a single cell, representing potentially the whole body. Such a germinal cell must contain molecules so constituted and arranged, that in their development each molecule, or each homogeneous group, will yield homogeneous cells, arranged as their molecules were arranged in the germ. And a final development of these cells must yield the special tissues which they are adapted to form.

Thus by dwarfing the body to microscopic dimensions, or until it be reduced to a single cell, this cell must represent in its molecular organization the physical organization of the whole body. Its molecules must possess the special polarities of the tissues, and be arranged as the tissues were arranged. And the interaction of the molecular polarities, must render this arrangement as necessary in the germ as the physical duty of the tissues renders it in the mature organism.

It might be imagined that such a germ would be greatly diversified in the character of its molecules. Yet no such necessity exists. The divergence from homogeneity in these molecules would probably be very slight. For diverse as are the physical characters of separate tissues, it is improbable that they vary greatly in chemical character. The protoplasmic bases of all the tissues are perhaps nearly homogeneous, minute differences in their chemical constitution, and in their polar affinities, yielding the wide divergence in the physical characters of the tissues. The physical analysis of a tree yields us striking evidence on this point. Here we find solidified woody fibers; there vascular tubes of varied form; here gum, there cork, there mucilage; here at least two varieties of starch; in the sap dissolved sugar; in the flower and fruit, liquid or solidified sugar, of several varieties. In these diverse tissues we have almost all the material of the tree. Yet when we come to examine them chemically we find them to be nearly the same thing. They are all composed of carbon with slightly different equivalents of water. And if the divergent tissues have but this slight chemical difference, how much less may be the differences in the protoplasmic nuclei to whose chemical activity they are due?

It is probable, therefore, that the protoplasm of the varied animal tissues has but minute differences in its chemical constitution, these minute differences being capable of yielding marked divergences in the physical results of their action. And the germ, which must contain molecules derived from every portion of the body, may be a nearly homogeneous mass of protoplasm, the minutest differences in its molecules being capable of yielding marked differences in the tissues arising from them.

The marvelously intricate germ of the human body is not produced but once, or but a few times. It is, on the contrary, continually produced, as if the body was incessantly employed in forming such minute and generalized copies of itself. For such a continual reproduction there must be some important physiological agency constantly affecting every tissue, or perhaps every cell of the body, so that these tissues, in addition to their ordinary duty, perform an unceasing generative labor. They are adapted to work not only for the needs of the single individual to which they belong, but for a possibly great number of future individuals, since, could the germs produced by each individual

develop, it might yield myriads of mature offspring. For such an important and continued function, provision must be made, and this provision must exist in some duty naturally arising from the chemical and organized constitution of the body.

Efforts have been made to explain this phenomenon, of which the most notable are those of Spencer and Darwin. Spencer advances a hypothesis of physiological units, in some way intermediate between the molecular and the cellular units of the body, and being in themselves generalized copies of the body. He does not think it possible that this generalism can exist in the molecules themselves.

The hypothesis advanced by Darwin is more satisfactory, though equally without visible support. He proposes the idea that every portion of the body is constantly throwing off invisible gemmules of excessive minuteness, some arising from the body itself, some brought into it from ancestral bodies. These gemmules, he thinks, contain the special characteristics of the part from which they arise, pass into the blood current, multiply by self division, and finally aggregate into a reproductive germ, whose development may reproduce the parent organism and, to some extent, that of more remote ancestors.

This pangenesis hypothesis approaches a physical explanation of the difficulty, although it seems in certain respects insufficient. In fact, no such hypothesis may be needed. If the body is engaged in so incessant a labor we might reasonably expect to discover some visible evidence of such an important function. And certainly a very cursory examination of the body yields us evidence which seems to offer a satisfactory solution of this difficult problem. It may seem strange if we assert that every portion of every tissue is constantly giving off, or in some way influencing the formation of organized substance; that this substance is not invisible, like the pangenetic gemmules, but perfectly visible; that it has no discoverable office in the body, and that its organization is that of a fully vitalized germ.

Yet such a material does exist, and is that known as the leucocyte, or the white blood corpuscle. The office of this corpuscle has been, and still is, a puzzle to physiologists. They suppose that it may be converted into the red blood corpuscle, yet this remains a supposition only. If we closely examine the origin and character of the leucocytes we may feel warranted in ascrib-

ing to them another duty and destiny. These corpuscles exist abundantly in the blood, but they also exist in equal abundance in the lymph, from which the blood seems to derive them. It is known that they arise independently in the lymph, and in any exuded blastema in contact with a living surface, as in the fluid of pus cavities.

But the lymph is a liquid which exists in direct contact with perhaps every cell of every active tissue of the body. It apparently originates in a nutrient fluid which exudes from the blood through the walls of the vessels. It bathes and yields nutriment to the active cells, and carries off their waste materials. And it seemingly carries off more than this, for the white corpuscles make their appearance in the most interior lymphatic channels, anterior to the lymphatic glands. Thus they arise in the blastema in direct contact with every portion of every tissue, and are possibly formed under the direct influence of the tissues in which they appear, if they are not indeed exuded and vital portions of the living tissues.

Their increased numbers in the lymph as it approaches the blood indicates a continued life action, a division resembling that of the individual Protozoan. In fact the whole behavior of these corpuscles significantly reminds us of that of the lower Protozoa. If existing outside the body, they would be taken for individual Amœbæ, for they are in organization and behavior indistinguishable from the lowly organized animal known as the Amœba. They constantly advance and retract pseudopodia, which process constitutes the amœboid life function, and are, like the Amœbæ, composed of a nucleated mass of protoplasm. Thus they in every respect simulate the lower Protozoa.

If the white blood corpuscles increase in numbers by division, as seems evident, they must also assimilate nutriment and grow. The constant change of form of the Amœbæ is a nutrient function, and it must have the same significance in the white corpuscles. In fact, we have direct evidence of this. They have been proved by the addition of coloring matter to their containing fluid, to absorb material from this fluid, retain it for a while, and then reject the innutritious colored granules.

There is only one function wanting to complete the whole cycle of Protozoan life, that of conjugation, or sexual union. This has not been shown to occur in the case of the leucocytes. But there

is no reason to conclude that it does not occur, and it is by no means improbable that their nutrient process consists, partly at least, in an assimilation of the molecules, or the budded gemmules, of other leucocytes.

With these preliminaries we may proceed to consider the hypothesis that the leucocytes are the true germinal particles, which embrace in their organization the chemical and physical characteristics of every region of the body, this generalism of constitution being produced by successive combinations of the leucocytes, until they finally produce composite germs which are true generalized copies of the whole body.

From this point of view the hypothesis which looks upon the animal body as a colony of individual cells may not be an untrue one. Each cell depends for its individual life upon the nutrient pabulum elaborated for it by the combined labor of all the other cells of the body. It does not go forth as an individual in search of food, for its proper food is brought to it. But though fixed in position, its individual life resembles that of the Protozoan. It assimilates food, grows, and divides into new cells. And it is quite possible that all these cells do not remain united. Some of them may be thrown off into the lymphatic fluid which bathes the mother-cell. Each cell may thus, in addition to its coherent offspring, send off independent offspring, to wander out into the world at large of the nutrient fluid.

Thus from every cell of the body may come wandering offspring, each a perfect copy of the mother-cell. The inducement to their being thrown off may be the better chances for nutrition offered by a free existence in the nutrient fluid. It is one phase of the struggle for existence and adaptation to circumstances, which displays itself everywhere in nature, from its lowest to its highest conditions. Possibly each cellular unit of the body performs a double duty. It acts both as a constituent part of the body and as a free individual. In its former office some of its daughter-cells remain coherent, and aid in the growth of the tissues. In its latter office some of its daughter-cells are budded off into the surrounding fluid to pursue an individual life of their own. In this respect it reproduces the Protozoan mode of life, in which all new cells are budded off into the surrounding fluid as separate individuals.

Such a process is not improbable in itself. We can with some

justice look upon the cells as individuals, and as, in their methods of development, concerned only for their own private interests. In the Protozoa the new cells are all set free because there is no advantage to be gained by their remaining coherent. In the Metazoa there is an advantage to be gained by coherence. They are adapted to a special nutriment, which is brought to them, and which they would fail to obtain unless united into a specialized organism. But the nutrient fluid from which they derive food, offers also a sphere of advantageous free existence. The cells are equally well situated when free as when coherent, and therefore the newly-formed cells are as likely to become free as to remain coherent. Possibly they have a somewhat better chance for life in the free state, as they are surrounded by a nutrient fluid exactly suited to their needs. Hence the free buds rapidly develop into actively vital cells, yielding what are known as the lymph corpuscles.

But these corpuscles are contained in a moving fluid. They are quickly borne away from their point of origin and thrown into the blood. Here the conditions for their free life are less favorable. They may fail to obtain the specially elaborated nutriment to which they are adapted, and thus may lose their vitality and possibly become modified into the red blood corpuscles.

The struggle for existence may be active between the leucocytes in the blood. Beale and Max Schultze describe minute globules in the blood which they suppose to be fragments (or gemmules) budded off from the white corpuscles. These may serve as nutriment to other corpuscles. If so the corpuscles must gradually acquire molecular conditions arising from varied regions of the body, and thus become more generalized in constitution and better adapted to the nutrient conditions of the blood. Possibly a considerable degree of generalization may be attained in this manner.

This process of cellular budding and the formation of free cells, is continuous throughout life. It has its phases of variation in the daily life of organisms. The leucocytes appear more abundantly after meals, and decrease in number during abstinence. But the nutrient and developing activity of the cells must display this same variation. Possibly the process of free budding may be more active in mature life than in youth. The rapidity of growth in youth indicates a strong tendency to coherence of cells,

though perhaps the more vigorous assimilative energy at that period of life may render both the coherent and the free cell formation very active. In mature life the cessation of growth seems to indicate a loss of the coherent energy. The great mass of the new cells are perhaps budded out as free individuals into the lymph, while only enough remain coherent to keep up the integrity of the tissues. In old age even this fails, and the body shrinks. It is becoming disintegrated by the growing preponderance of free over coherent cell formation. It is not improbable that the increasing thickness and density of the tissues may have some influence upon this result. Nutriment reaches them less readily, and the new cells are more advantageously situated in the free than in the coherent state.

Thus the independent life of the cells becomes, as life goes on, less and less subordinated to the needs of the body. Each coherent cell buds off minute gemmules, or organic units, which quickly assimilate nutriment from the rich plasma surrounding them, and grow into amœboid cells. These buds may be, in many cases, very minute, for corpuscles will arise in an apparently homogeneous blastema. Some writers argue that this blastema is structureless, but it is not easy to credit that it is destitute of the germs of organized structure. These may be excessively minute masses of molecules, invisible gemmules derived from the tissues, but they must be present as centers and controlling agents of the organized corpuscles which quickly appear. We are, therefore, forced to believe that the colony of coherent cells which forms the body as a whole, gives rise to a colony of free individuals, which swim off and develop in the surrounding fluid, precisely as the budded offspring of a lowly organized animal float away to develop as independent individuals. The body continues to absorb nutriment, but the products of its nutrition flow away and resolve themselves into a swimming colony of single-celled organisms. Cessation of individual life becomes necessary from the increasing tendency of the body to resolve itself into its elements.

If now we hastily review the process of reproduction throughout the range of animal life, we shall find it to favor the hypothesis here proposed. Everywhere there seems a struggle between the opposite tendencies of new germs to remain coherent and to become independent. The result undoubtedly strictly depends

upon the advantage in nutrient relations between the free and the coherent state. In the simplest organisms the new cells remain free. They would derive no advantage from coherence with the mother-cell, and they are fully capable of continuing the species, since they contain all the molecular conditions of the type. Here there is no growth, the whole life process is a reproductive one. In less simplified forms, such as the Foraminifera, both tendencies are displayed. Possibly the armored condition of the type renders it advantageous for coherence to continue up to a certain stage, yet independent cells are incessantly budded off. In the highest Protozoa a molecular differentiation seems to arise between the different parts of the single celled organism, and this is probably the primitive stage of the cellular differentiation in the Metazoa. The special molecules of the Infusorian represent the special cells of the Metazoan. In the latter type of animal a considerable degree of coherence becomes absolutely necessary, yet it is probable that in the lower forms free cell formation is very active. There are two purposes to be subserved in the organism, the continuance of individual life and the reproduction of the species. For the one, cell coherence is necessary. For the other, cell freedom. And both of these are favored by the nutrient conditions. The specialized nutriment bathes the cells, and the new cell products can gain nutrition both as coherent and as free cells. But the process of reproduction is not as simple as in the Protozoa. No longer does every portion of the body represent the whole body. The free buds thrown off by the cells into the nutrient fluid represent only a special section of the body. Only by some process of combination can cells be produced containing the molecular constituents of the whole body. And it is probable that this combination is a natural resultant of food assimilation by these free cells. They take in nutriment, grow, divide or bud off minute gemmules, and these gemmules are taken up as nutriment by other cells. Thus fully generalized cells are produced, capable of existence outside the body, and adapted to develop into a copy of the parent organism.

As the animal becomes of higher grade the process of tissue formation preponderates over that of germ formation, the number of developing germs decreases and the resolution of the body into its offspring becomes less declared. From being total it becomes partial. In fact, as specialization increases the combina-

tion of the cell germs is not so readily achieved, while it becomes necessary for the reproductive germ to be provided by the parent organism with suitable food for its first stage of development. In the most advanced stage of this process the germ must be retained and develop within the parent organism until its specialization has become nearly complete. This necessity adds to the importance of individual life. Where the germs ask no further aid from the parents, the latter cease to exist, all their strength going into the germs. Where the germs ask considerable aid from the parents, the latter must retain much of their vital strength, and cannot completely disappear in their offspring. Where, as in man, the offspring is fully developed through parental aid, the life vigor of the parent cannot be exhausted by that of its offspring, particularly as the continuance of the species needs long continued successive production of offspring. The vital strength necessary for this purpose only slowly declines, and continues long after the period of child-bearing is past.

Thus there is a gradual advance from the condition in which all new cellular individuals become free, to that in which the greater number of new individuals remain coherent. Where the organic specialization is slight, the cells are more likely to be budded off into the free state than to remain coherent. In such organisms the reproductive power is great. Countless buds are thrown off by the cells of the tissues. The aggregation of a few of these suffices to yield a cell containing all the molecular conditions of the parent form. Thus reproduction is specially vigorous, and the life of the race greatly preponderates over that of the individual. As specialization increases, this process is gradually checked. Growth power gains upon reproductive power; the life of the individual upon that of the race. Gemmules may be budded off into the nutrient fluid as freely as before, but fewer of them attain full generalization, as this process is a much more complex one. And those which fail to do so are probably reconsumed by the body as nutriment, and go to aid the growth process.

(To be continued.)

NOTES ON THE HABITS OF SOME WESTERN SNAKES.

BY H. A. BRONS.

WHILE connected with the Geological Survey of the Western States, I had the opportunity to note some peculiar, and as far as I am aware, unreported habits of some of the snakes.

Several of the summers I passed upon the plains were preceded by rainy springs, swelling to unusual height the small streams which became inhabited by small fishes. During the drought of hot summers, the receding waters left the fishes in shallow pools within creek beds, an easy prey to their numerous enemies.

The mid-day heat caused numbers of snakes to seek shelter from the sun, and the garter snake *(Eutænia radix)* in particular, chose water at this time. Here the fishes, unable to escape or find deep cool water, were unwilling co-tenants with the snakes. The latter are fond of fish, and would devour great numbers of the smaller ones, chasing them from one part of the shallow pool to another. When the fishes were in water too shallow to swim in, or were struggling upon the sand, they would be seized by the snakes, who would feed upon them until unable to contain more. The snakes would follow the fish through the water, diving and remaining submerged some time. I did not observe them swallow air (see AM. NAT., Jan., 1880). Snakes evince more than ordinary energy and sagacity in capturing fish; half a dozen will congregate within a small pool, all acting in concert.

Mr. J. L. Wortman, who had charge of a scientific party last year, informs me that while fishing one day he caught numbers of chub *(Cyprinidæ)* and, throwing them on the sand, was surprised to see that but few remained. While quietly continuing to replace those so singularly missing, he observed a garter snake seize and swallow one of the fish six inches in length. There were two of these snakes reaping the reward of Mr. Wortman's skill. Upon opening the snakes one was found to contain six fishes. The head-waters of the Smoky Hill and Big Horn rivers abound in this aquatic *Eutænia radix.*

In Texas, while fishing with a common hook and line, baited with a small scale fish, I had the rare fortune to hook what at first seemed to be an eel, but proved a "cotton mouth" snake *(Ancistrodon piscivorus).*

One morning on examining a line set over night, found the pole as left the previous evening, but the line drawn to shore, and my curiosity was excited as to the catch. It proved to be one of these snakes, coiled upon the bank, the bait, a small scale fish, mashed within its mouth, and the hook well caught. Upon being disturbed it at first showed fight, but took quickly to water, and was landed with the same effort as a fish or eel of equal size, *i. e.*, about twenty-six inches in length. That season I caught three of these venomous snakes in this way while fishing with a hook and line. By Mexicans living on the banks of the San Antonio and San Maguil rivers, I was informed that it is no unusual thing to catch cotton mouths while fishing.

Running short of bait one day, I caught several large toads and tied them together by their hind legs. On nearing the water a snake started to cross the stream; having nothing else to throw at it, I gave the toads a toss in front, hoping to change its course; the snake seized quickly on the struggling mass. Toads exhibit great fear of snakes; it will afford considerable amusement to take a toy or stuffed snake skin and trail it towards one; it will make a strange cry, at the same time making vigorous jnmps to escape. Frogs act in the same way, though they are not so readily captured.

Nearly all animals show unmistakable signs of fear when confronted by a snake, though many that do not prey upon them take delight in destroying them, as do the deer family, etc.

Prairie dogs *(Cynomys ludovicianus)* seem to have a most intense dread of rattlesnakes *(Crotalus confluentus)*. This little animal dreads not only its venomous bite, but more the loss of its young, which serve as food for these snakes that enter their burrows, take possession and drive them from their homes. Where does one find a prairie dog town but that it is teeming with snakes and the strange little owl *(Speotyto cunicularia)* that "ducks" to passers in ludicrous solemnity? These, though billeted upon the dogs do not constitute a "happy family." The owls, though they generally occupy an abandoned hole or burrow, destroy the young dogs. Nor do the eggs and nestlings of the owls fare with any better treatment from the snakes; between these exists much enmity. One afternoon while passing through one of these dog towns, in Wallace county, Kansas, we heard a most unusual noise and stir (in the town) as though they were

holding a bellicose council. They were collected around a hill,[1] into which they were scraping dirt vigorously. On examining the burrow it was found to contain a large rattlesnake that the dogs were trying to entomb. I noticed this several times, as did other members of our party. To leave no doubt upon the subject we dug out the snakes after shooting them.

The habit of swallowing whole eggs is too well known to merit more than mention. But few persons realize the mischief snakes work in destroying the nests and young of our valuable birds. It is not an unusual occurrence to find whip *(Bascanium flagelliforme)*, racers *(Bascanium constrictor)* and bull snakes *(Pityophis sayi)*, with the entire contents of quail, prairie hen or domestic fowl's nests within their capacious stomachs. With a little care they may be compelled to disgorge the ingesta unbroken.

During the breeding season the odor of many snakes is quite distinct and perceptible at some distance. This is markedly so in the rattlesnake *(Crotalus confluentus)*, its musky and fœtid emanations are quickly recognized by frontiersmen.

The manner of union of the sexes at this season is rather instructive. The female among the racers (Bascanium) is larger and darker than the males, and not so graceful in form or movements, she, at times, seems to toy with the male, indisposed to yield to his importunities, though pressed with ardor. To avoid his suit, at times, she will dart through grass, among stones, or enter a crevice. Should he be able to reach his mate while within a hole, he is not slow in bringing her to the surface, again to be repulsed. Upon an unbroken ground the sexual communion is less prolonged. Here she is unable to free herself from his quick and effectively directed moves. In case she attempts to quit him, a coil is thrown about her body, and his head laid flat upon her neck, and replaced as promptly as dislodged, evidently in the endeavor to propitiate her.

Of all strange habits in snakes, none equals that observed in the blowing adder *(Heterodon simus)*. One afternoon returning to camp, I came upon a box turtle *(Cistudo ornata)* trailing along one of these snakes, which had a firm hold upon the turtle's left hind foot. The turtle was unable to free itself of its tormentor, as its hold was quite secure; so persistently was it maintained that I lifted the turtle by grasping the body of the snake. Con-

[1] The prairie dogs throw up a bank levee about the mouth of their burrows.

siderable force was required to separate them. The snake was about twenty inches long, the turtle eight inches. The foot was bleached, and blood was still flowing; none had apparently escaped from the mouth of the snake. Two toes were missing, having been digested from the foot. The entire foot appeared as though it had been subjected to a continued maceration within the mouth of the snake.

Twice afterward I noticed this strange habit of the puff adders. The late Professor Mudge mentioned to me that he had observed this habit in these snakes. I have not been able to find any signs indicating that the snake ever attaches itself to a fore foot. It seems as though they choose a foot that the turtle is unable to defend. The neck can not reach the hind foot as it can the front, and free it of any object that may attempt to lay hold upon it. The carapace may protect the tail.

I took pains to examine many box turtles *(Cistudo ornata)* that occur along the Smoky Hill rivers, and many, one can safely say one-half, are deformed in their hind feet. Very little deformity is found in the front feet. It must not be taken that all, or even a majority of these deformities are caused by adders. It is not on account of want of food, for there is never a lack of the insects here upon which the snakes generally subsist. It is not thirst, as the habit is practiced where there is water. The appearance of the foot, and the inability of the snake to masticate, would preclude any solution other than the desire to obtain blood as it flows from the lacerated parts.

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THE LIMIT OF THE INNUIT TRIBES ON THE ALASKA COAST.

BY IVAN PETROFF.

CIRCUMSTANCES over which I had no control detained me for several months during last summer and autumn in the section of Alaska where the Innuit and Thlinket tribes meet and to a certain extent intermingle with each other. I refer to the Alaskan coast between Prince William sound and Mt. St. Elias.

During a former residence and subsequent continuous travels in Alaska, I have paid particular attention to the distribution of the Innuits. It had always been a question of practical interest

to me, because progress through Innuit territory was always comparatively easy and uninterrupted except by natural obstacles, while every excursion into the country occupied by other tribes was attended with open or secret opposition on the part of the natives, and occasional threats of violence or even overt acts of hostility.

In the course of my explorations, extending over a period of several years, of all the coast from Bering strait to the vicinity of Mt. St. Elias and of the river systems, I had found the Innuits occupying the coast and interior wherever nature has thrown no obstacle in the way of free navigation in their kaiaks or skin-covered canoes; and consequently this eastern limit or boundary of the long chain of homogeneous orarian tribes was a locality of peculiar interest to me. The tribes who now have their homes in this vicinity are the so-called Chugach, of purely Innuit extraction; the Oughalentze, or Oughalakmute of Innuit extraction, but now mixed with Thlinkets; and thirdly, the so-called Chilkhaat tribe of the Thlinket family, settled on Comptroller's bay and up to the left bank of Copper river. The Chugach, whose name is a Russian corruption of their own tribal name of Sh-Ghachit Shoit (the latter word means simply "people"), partake of all the characteristics ascribed to the Innuits of the Alaskan coast south of Bering strait. They hunt marine mammals in preference to land animals, and their whole domestic economy and mode of life rests upon the use of the kaiak or bidarka. The Ougalakmutes have always been the easternmost branch of Innuit stock along the coast. The earliest Spanish and English visitors to Prince William sound described more than a hundred years ago, the natives of that region just as we find them now, and I have been unable to discover any proofs of the existence of these tribes farther down the coast. It is true that in one instance Lieutenant Ring, of the U. S. Army, reported the discovery of relics apparently of Innuit type, in shell heaps near the mouth of the Stakhine river, and a few skulls, said to be of the same type, have been found in Santa Barbara county, California. Both of these can be easily accounted for by the compulsory wanderings of Aleuts and other Innuits under the Russian rule at the end of the last and the beginning of the present century. Thousands of Innuit hunters who accompanied their iron-willed masters down the northwest coast of the American continent were slain and

captured by the more warlike Thlinkets, and a few skulls in Santa Barbara county may be all that is left of the prisoners taken on that very coast from sea-otter hunting expeditions undertaken by English and American skippers who were furnished with Innuit hunters by the Russian authorities at Sitka.

I am aware that my classification of these tribes conflicts with that adopted by Mr. William H. Dall in his essay on the Distribution of the native tribes of Alaska, in Vol. I, Contributions to North American Ethnology. Mr. Dall's personal intercourse with these people must have been of brief duration, or he would not have confounded the Chilkhaaks and the Oughalentzes. The name of the latter in its proper form of Oughalakmute simply means "far away people;" Oughaluikhtuk in the Chugach dialect meaning "far distant." Mr. Dall also was mistaken in his assertion that the Copper river or Ah-Tena Indians had forced their way between the Thlinkets and the Innuits, and hold a small part of the coast.

These Indians do not hold now and never did hold, as far as it is possible to learn, any portion of the coast. A small number of them, consisting of traders only, visit the post of Nuchek or Port Etches every year, but to enable them to accomplish this voyage, they purchase large bidars or skin-covered boats of the Innuits. In their own country birch bark canoes form their only means of navigation.

We have every reason to believe that formerly the Innuits occupied the coast as far as the indentation commonly called Icy bay, but the constant pressure of the stronger Thlinket tribes has caused them to recede gradually to the localities occupied by them at the present day. In the vicinity of Icy bay the glaciers of the Mt. St. Elias range of Alps reach down to the coast, forming a long line of icy cliffs, a stretch of coast affording absolutely no landing place for boats or canoes. This feature has proved an insurmountable obstacle in the way of kaiak navigation, necessitating as it does a continuous sea voyage of between two and three days without making a landing. The Innuit in his kaiak could not accomplish this, but the Thlinkets in their large wooden canoes, provided with masts and sails, could easily traverse this distance, with favorable winds, without being obliged to land.

When the Russians first came into this neighborhood, they found the two tribes struggling for supremacy; the Muscovite

invaders, consulting their own interests, gave their assistance to the weaker tribe, and during their occupation of the country put a stop to a further advance of the Thlinkets. Only fifteen years have elapsed since this restriction was removed and already we see the effect in the absorption of former Innuit territory by the Kolash.

Every fact I have been able to collect in connection with tribal movements over this debatable ground, points to a migration of the Innuits along the Alaskan coast southward and eastward until they met the Thlinkets, and until stopped by the long stretch of inaccessible cliffs and icy promontories already mentioned. I am also inclined to believe that the whole movement originated from the American Arctic coast at a period subsequent to the invention of the kaiak. Within the last twenty years I have observed instances of individual migration at various points of the Alaskan coast, but always in the same direction. I have found individuals and families from the Lower Yukon in the vicinity of Bristol bay and in the interior of the Alaska peninsula. The Mahlemute or Koikhpagamute of to-day looks to the southward and eastward as the direction in which to find a better country, just as his ancestors did centuries ago.

Mr. Dall, in the paper above referred to, seems to adopt the theory of the gradual advance of the Innuits from the interior of North America to the coast before the impulse of successive waves of other tribes behind them. This theory, first promulgated by Dr. Rink, is entirely tenable if we suppose that these waves of retreating Innuits reached the coast first in high altitudes, in a region devoid of timber, such as would lead to a change from the habits of an inland people to those of the modern Innuit, and to the final invention of the kaiak. If, in accordance with this theory, the Innuits were driven northward along the coast to their present homes before the onset of the Thlinket tribes, the natural conclusion would be that the rear guard of the vast Innuit army stopped about the region of the Copper river country, where we find them to-day. This region and the whole of Prince William sound, as well as the shores of the Kenai peninsula, are densely wooded, and the question arises, how came these people to adopt the use of the kaiak when they are surrounded with every facility for constructing canoes from the same material that they must have known and applied to the same pur-

pose in their southern or interior home? The natural barrier to kaiak navigation mentioned above, has been passed ages ago by the Thlinket tribes, but these never adopted the use of the kaiak; they still hunt and travel in their dugouts that they brought with them from their former homes in the south-east. The exclusive use of the kaiak or bidarka in this Alpine region, with dense forests and dangerous beaches, can only be explained by the emigration of the people from other regions devoid of timber. From whatever direction the Innuit people of Prince William sound and the Copper river delta came, they brought with them the kaiak or it never would have been invented there. The Oughalentze, who are now confined to two villages, Alaganuk and Ikhiak (called Odiak by the traders), have already ceased to construct bidarkas, owing to the preponderance of the Thlinket element among them. Their houses are constructed on the Thlinket plan and the younger generation speaks the Thlinket language only, while the older men and women speak both the latter and the Innuit. The Chilkaats, on the other hand, offer to the observer but few faint traces of their Innuit intermixture, and in their intercourse with Chugach Innuits and the traders, they use interpreters. They wear blankets exclusively.

The end of the Innuit element is here very clearly defined. Here, as everywhere on the Alaskan coast, the traveler will at once observe the extreme caution with which the Innuit moves and acts as soon as he finds himself among people of another tribe. In their own country they always endeavor to pass the night at some village, but as soon as they enter foreign or even debatable territory, the camp is pitched far away from the habitation of man, even when they are escorting a white man. On this terminal line of Innuit population, the feeling amounts to abject fear. Money will not tempt the Chugatch to advance into the Thlinket country.

An argument in favor of my theory concerning the more recent period at which the Innuits spread over the Alaska coast may perhaps be found in the existence of a branch of this tribe on the Aleutian islands. I fully agree with Mr. Dall that the theory of an Asiatic influx of population over the Aleutian chain of islands is entirely untenable, and that they were peopled from the east, but I do not think that this migration took place before the invention of the kaiak. Timber evidently never existed on these

islands; the only equivalent being the drift wood collected along the beaches and promontories, but this kind of material, water-logged and sodden, was entirely unfit for the manufacture of wooden canoes, or even for the construction of rafts, by which means Mr. Dall supposes the early Aleuts advanced from island to island. The frequency of gales, the violence of currents and the width of channels between these islands would also prevent the use of rafts as means of transportation and traffic. The assumption that the earliest inhabitants of the Aleutian islands were without a kaiak or boat of some kind, is based upon researches in the shell heaps of abandoned village sites on those islands; but a kaiak with a whalebone or even a wooden frame without its modern ornaments of ivory and bone, contained no material that would withstand decay and final absorption. The skin covering when worn out and unfit for use as such, was, no doubt, then as now, cut up into straps and patches, or served as food in time of famine, while the frame could be utilized in many ways that would leave no trace behind. The mere absence from the lower strata of shell heaps of anything pointing to the existence of the kaiak, can scarcely be considered as proof conclusive of its non-existence. My personal observations have led me to believe that the remains of former villages and dwellings found on the Aleutian islands and on the continental coast of Alaska, are not of the antiquity ascribed to them. Wherever I had the opportunity to observe such localities at long intervals of time, I was astonished at the rapidity with which nature extinguished the traces of man by a growth of sphagnum and other vegetation, giving to the site of the village abandoned but a few years, every appearance of great antiquity.

The absence of stone and bone implements of more delicate construction from the lower strata of the shell heaps can easily be attributed to the same cause that explains the absence of iron implements from the upper layers that must have accumulated within historic times. Such articles were the product of much labor, and consequently too precious to be lost. At every successive removal from one dwelling place to another all such products of their ingenuity were carefully collected and removed by the ancient Aleuts, just as it is done now with regard to iron by the natives of the present day.

On these treeless isles the removal from one hunting or fish-

ing ground to another of a few families or a community, always involved the transportation of every log or plank and every particle of wood to be found about the place. As an instance of this kind, I may point to the removal of the people of Makushin, on Oonalashka island which took place in the early part of the year 1879. In the summer of 1880 I visited the spot from which the people had removed, and found the outlines of every house indicated by a slight depression in the ground and enclosed by low ridges of earth covered already with a dense growth of sphagnum and grasses. Every piece of wood about the whole settlement had disappeared simultaneously with the people, and I have no doubt that an explorer unacquainted with the circumstances could dig up these remains without finding a scrap of iron, or anything indicating their recent occupation by at least semi-civilized people. Another example of this kind, and even more forcible in total absorption of all signs of recent occupation, can be found on the island of Atkha at the site of the former settlement of Korovinsky, the people of which removed to Nazan on the other side of the island, less than fifteen years ago.

In the settlements remote from the trading centers the people of Innuit stock live to-day as they did probably centuries ago, in a manner not at all inconsistent with the remains found in the lower strata of shell heaps. Even the presence of stone and bone arrow and spear heads is no true indication of age, as they are manufactured at the present day, as I had an opportunity to witness frequently during my travels in remote regions.

The time required for the formation of a so-called layer of "kitchen refuse" found under the sites of Aleutian or Innuit dwellings, I am also inclined to think less than indicated by Mr. Dall's calculations. Anybody who has watched a healthy Innuit family in the process of making a meal on the luscious echinus or sea urchin, would naturally imagine that in the course of a month they might pile up a great quantity of spinous débris. Both hands are kept busy conveying the sea fruit to the capacious mouth; with a skillful combined action of teeth and tongue, the shell is cracked, the rich contents extracted, and the former falls rattling to the ground in a continuous shower of fragments until the meal is concluded. A family of three or four adults, and perhaps an equal number of children, will leave behind them a shell monument of their voracity a foot or eighteen inches in

height after a single meal. In localities in Prince William sound I had an opportunity to examine the camp sites of sea-otter hunters on the coast contiguous to their hunting grounds. Here they live almost exclusively upon echinus, clams and mussels, which are consumed raw in order to avoid building fires and making smoke, and thereby driving the sensitive sea otter from the vicinity. The heaps of refuse created under such circumstances during a single season were truly astonishing in size. They will surely mislead the ingenious calculator of the antiquities of shell heaps a thousand years hence.

On the coast of Cook's inlet I have observed other instances of the rapid transformation of dwelling sites.

In the year 1869 I erected a substantial log house in the vicinity of the village of Chkituk. I visited the spot last summer and discovered nothing but faint lines of the foundation of my house indicated by low ridges overgrown with mosses and grasses, and two young spruce trees growing up from the spot where my fireplace had been located. In the same locality, at the mouth of the Kaknu or Kenai river, the remains of the first log building erected there by the Russians in 1789, can now be seen protruding from the almost perpendicular river bank fifteen or twenty feet under the present surface.

As an instance of the rapidity with which the tides of this region will change outlines of coast and other land marks, I may cite an observation made by me during my stay on Nuchek island last summer. At a short distance from the settlement there was a cave in a rocky cliff situated about three or four feet above high water mark. I visited the place frequently, as it afforded a view over the approaches to the harbor. About the middle of June an eclipse of the moon occurred when it was full or nearly so, causing tidal commotion of unusual extent and violence. When I visited my cave on the day following the eclipse, I found it almost filled with shingles and débris. This cave was situated at about the same height above the water as the cave of Amaknak, from which Mr. Dall extracted such voluminous information as to the antiquity of strata of refuse found therein. I cite these instances only for the purpose of showing that it is not safe to ascribe great age to any and all accumulations of débris found on the coast of Alaska, and also as a support for my theory of a general Innuit

migration along the coast at a comparatively recent period, subsequent to the invention of the kaiak or a similar structure.

The lines of demarkation between the Innuits and Thlinkets in the St. Elias Alpine region are very clearly drawn, and we can account for the presence of the former with the very customs and habits characterizing their kindred in the north and west among entirely different surroundings only by a migration southward after these habits were formed, and thus far I have been able to obtain no authentic information of any real traces of Innuit occupation beyond the point indicated.

The existence of man on the Aleutian islands and the coast of Alaska prior to the arrival of the tribes, we know is at best problematical. Traditions pointing in that direction are by no means wanting among the Aleuts, but our only authority for their existence is Veniaminof. The fable of supernatural beings dwelling in the interior mountain fastnesses of the islands related by Mr. Dall is based upon a failure to recognize a common Russian word. The "Vaygali" or "Vaygli" referred to by that gentleman were fugitives or outcasts who fled from the villages on account of crimes committed, and led a brief and wretched existence among the barren hills. The Russian word "Vaglai" means simply "fugitives."

From a Shaman of the Chilkhaak tribe, who boasted of his pure Thlinket extraction, I learned that a tradition exists among his people that in times past their ancestors held all the territory to the westward clear to the shores of "another big sea," but that the Innuits came from the north, as he expressed it, like "herrings"—each in his own kaiak. The sea was covered with men, while women and children trudged along the shore. There was much fighting and a final retreat of the Thlinkets, but they would one day recover their own.

One unsupported tradition of this kind, of course amounts to nothing. I give it here only for what it is worth. One thing, however, has become clear to my mind during last summer. Unless unforseen events interfere, the southern limit of Innuit tribes on the Alaskan coast will not be the same as it is now a century hence. Wherever a mixture with the Kolash has taken place, the latter rapidly gain the upper hand, and in a comparatively brief time the Innuit element is completely absorbed.

EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— Perhaps the Secretary of the Treasury desires to aid the friends of repeal by a *reductio ad absurdum* of some of the provisions of our tariff law. By a ruling of his department made some time last month, all books coming through the foreign mail for private persons are charged a duty of 25 p. c. if of the value of $1.00 and over. To collect this amount the book must be sent from the post-office to the custom house, then from the custom house to the appraiser's store, where a valuation is put on it. It is then returned to the custom house, from which a notice is issued to the addressee. All this requires the filling of blanks and the obtaining of the signatures of eleven or twelve officials, by which the government is richer frequently by 25 or 50 cents. A more disreputable law it would be difficult to imagine. Only the poor student is taxed in his efforts to elevate himself above the general dead level. The aspirations of the seeker for knowledge have, it seems, to be paid for, although by following them the student usually resigns the opportunity of financial success in life. We know very well that it is not the producers of books in this country that desire protection. The sale of their wares abroad depends on their merits, and the production is not to be stimulated by a protective duty. It is the publisher who, like another noted character, sits

"Hard by the tree of knowledge,"

to whom we are indebted for this beautiful piece of legislation. Of course we may be wrong. It may be clear to greater minds than ours, that by taxing the books of Gegenbaur, Claude Bernard and Owen, we develop our native genius, and cause little *fac-similes* of these gentlemen to come immediately into being. By increasing the pressure we might squeeze out Meissoniers and Whistlers. Tighten the prohibition, and hear the land resound with the harmonies and melodies of a crop of Verdis, Wagners and Sullivans. But possibly the framers of this law were moved by far different aims. They wish to prevent the influx of corrupting scientific literature into the country. Haeckel, Darwin and such men should not be permitted to instill poison into the minds of our young men and women. Or if people will have it, like poison, they must pay for it.

No doubt the tax on foreign animals for zoölogical gardens was also intended to prevent the spread of immorality—animals

imported for breeding purposes being free. The tax on natural history collections from foreign countries is without exception, because the animals being in bottles, cannot breed.

We are not opposed to a protective tariff under certain circumstances, but we are opposed to a tax on the intellectual development of our people. It is worse than blood-money, it is soul-money. It is a discrimination against the cultivators of thought and mind, and intelligent members of our National Legislature must surely, ere long, see it in this light.

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RECENT LITERATURE.

KNOWLEDGE.[1]—We hail with pleasure the advent of a new scientific periodical, devoted not to any one branch of scientific inquiry, but to all, and giving promise, from the character of the issues of the first four months of this year, to prove not only a valuable but also a highly interesting addition to the periodical literature of the English language.

This weekly magazine, ably edited by the well-known astronomer and lecturer, Richard A. Proctor, seconded by numerous scientific men whose names are guarantees of an excellent quality of work, is conceived upon a somewhat different plan to the now well-established *Nature*, to which it bids fair to prove a formidable rival. While *Nature* is principally a scientific newspaper, giving reviews of recent works and notices of current scientific events, *Knowledge* is chiefly occupied with lively short articles upon the topics which at the moment possess most interest. Among these we notice a series of papers in which the editor gives a common-sense explanation of the purposes of the Great Pyramid, refuting utterly the wild fancies indulged in by Piazzi Smith and others, and showing that the passages in the vast pile were most probably formed for the orientation of the pyramid, and used afterwards for astronomical or rather astrological observations during and in connection with the life of Cheops, the king whose sepulchre it finally became. Among other contributors we notice the names of Professor Grant Allen, who in his usual happy style gives us a "Beetle's view of life," and also a series of papers upon "Our Ancestors," the Euskarian or Silure, the Celt, the Teuton; of Dr. Ball, astronomer royal for Ireland; of Dr. W. B. Carpenter, Dr. Andrew Wilson and H. J. Slack, all of them writers whose power of description is equal to their acknowledged acquaintance with the subjects they treat upon. The old prejudice against the popularization of science is rapidly passing away; the leaders in scientific thought, the Huxleys, the Darwins, and their friendly rivals, find time to tell the people some of what they know, with

[1] *Knowledge*, an illustrated Magazine of Science, plainly worded—exactly described. Conducted by RICHARD A. PROCTOR. Wyman & Sons, Gt. Queen St., W. C. London, England.

the full belief that what is good for them is good for all. It is only the little minds, the confirmed scarabeists (to make use of Dr. O. W. Holmes's amusing example), the men who cannot rise above the level of a list of species or an account of the metamorphoses of a monad, that affect to believe that science is a sacred thing, that should, like the mysteries of the Egyptians, be the sole property of a few priests.

Let all, then, who wish for information combined with the entertainment of the highest faculties of the brain, promptly subscribe to *Knowledge.*

ANIMAL ANALYSIS.[1]—This work is a series of blanks to be filled by the student, like those which have been introduced into the study of botany with such success. They are essentially necessary to a proper study of zoölogy in schools, and we are glad to see so good a beginning made in supplying the need. We hope, however, that some changes will be made in them as presented in this first edition. The Batrachia and tortoises are omitted—a serious error, since these animals, especially the former, are the most available and most easily analyzed of all the Vertebrata. In the snakes, examination of the teeth is not required—a great omission. Finally the order to which a species belongs is not required, thus losing one of the principal points of diagnosis in the Vertebrata.

BIOLOGISCHES CENTRALBLATT.[2]—It is not often that a new scientific journal attempts more than to represent either some well acknowledged department, or more frequently some specialty, since every year brings us new specialties clamoring for recognition. The fortnightly publication, which we wish to notice here, is distinctly general in its scope and aim. The first volume, now completed, shows that this periodical fills an unoccupied and important field with marked ability and success. This *Centralblatt*, one of many, attempts chiefly to give abstracts of the *most valuable and important* researches, as far as possible those of general interest; special prominence is given to summaries of the results obtained concerning any subject, our knowledge of which has been increased by several separate investigations. The sciences included are botany, zoölogy, physiology, scientific psychology and a little pathology. The selection of matter has thus far been extremely judicious, so that we have an excellent presentation of the greater part of the most noteworthy current biological discoveries. Indeed we think the *Biologisches Centralblatt* may be justly described as indispensable to the general student. The

[1] *Animal Analysis for use in Schools and Colleges*, especially adapted to accompany Jordan's Manual of Vertebrates. By B. W. EVERMANN. Jansen, McClurg & Co., Chicago.

[2] *Biologisches Centralblatt.* Unter mitwirkung von Dr. M. REES, und Dr. E. SELENKA, herausgegeben von J. ROSENTHAL. Vol. I, 8vo, Erlangen. Edouard Besold, 1881–82.

appearance of the journal in point of mechanical execution is excellent, though the substitution of simple *T* for *Th* in all cases, being unusual, seems at first amusing.

We will only add a brief mention of some of the general summaries or essays, to indicate the range of subjects: *Berthold*, Fertilization of Algæ; *Klebs*, Movement of vegetable Protoplasm; *Sprengel*, Orthonectidæ; *Wiedersheim*, North American Palæontology; *Bischoff*, Weight of the human Brain; *Kraepelin*, Duration of simple Psychic Processes; *Exner*, Functioning of the facetted Eye. The list might be greatly lengthened, but we believe that the titles quoted suffice to demonstrate the wide scope embraced. Several of the original articles are meritorious contributions, and the numerous abstracts make up a good introduction to the best current biological literature. We hope that American naturalists will support this valuable enterprise by their subscriptions. The price is very moderate, fifteen marks for a yearly volume of 800 pages.—*C. S. M.*

PAGENSTECHER'S GENERAL ZOOLOGY, 4TH PART.[1]—The fourth part of this voluminous work relates to the excretory organs of animals, thus ending the consideration of the organs of vegetative life; and also to the external covering or integument of the body of animals. We have to make the same criticism regarding the cuts as in our former notice, the illustrations being too diminutive and not clearly drawn and engraved. The lack of subdivision into sections is only partly made up by a detailed and excellent table of contents. It is a useful work, valuable for reference, and the author is careful to cite his authorities.

BROOKS' INVERTEBRATE ZOOLOGY.[2]—It is with great pleasure that we have examined this work, and in a hasty manner read portions of it. The scope of the work is best indicated by the following extract from the preface: "This is a hand-book, not a text-book, and the entire absence of generalization and comparison is not due to indifference to the generalizations of modern philosophical morphology, but rather to a wish to aid beginners to study them." Following out this idea, Dr. Brooks, in a very thorough manner, takes up in succession the Amœba, Vorticella, Paramœcium, Grantia, Eucope, Mnemopsis, starfish, sea urchin, earth-worm, leech, crab, lobster, Cyclops, grasshopper, Lamellibranch and squid. The method of treatment is modeled somewhat after that in the well-known and much used "Biology" of Huxley and Martin, and we think will be found to be a great improvement upon it. With each form we have detailed accounts

[1] *Allgemeine Zoologie oder Grundgesetze des thierischen Baus und Lebens.* Von H. ALEXANDER PAGENSTECHER. Vierter Theil. Mit 414 holzschnitten. Berlin, Verlag von Paul Parey, 1881. Preis 21 mark. 8vo, pp. 959.

[2] *Hand-book of Invertebrate Zoology for Laboratories and sea-side Work.* By W. K. BROOKS, Ph.D., associate in biology and director of the Chesapeake Zoological Laboratory of the Johns Hopkins University. Boston, S. E. Cassino, 1882. 8vo, pp. VIII + 392. $3.

of the various steps to be taken in order to acquire an autoptic and thorough knowledge of its structure and, in all but one or two forms, of its development as well. These directions for study are almost invariably full, clear and explicit, while the numerous outline figures (of which there are 202) give one an idea of what to look for, and at the same time form a useful basis for comparative study. These figures are for the most part clear and easily understood, and possess one very pleasing feature, they are original and have a freshness not always found in books of like character. The book is well printed, and is a credit to its publisher; the typographical errors are few, as are those of the text; to one or two of the illustrations and a few of the statements of the text, we would not agree, though the points in question are of minor importance. On the whole we regard the work as by far the best text-book for laboratory work.—*J. S. Kingsley.*

HARTMAN ON PARTULA.[1]—The genus *Partula* was founded by Ferussac in 1819. The species of this genus have been referred to various genera by authors, as to *Helix*, by Müller; *Ottis*, Hump., 1797; *Awris*, Klein, 1753, to which they were referred by Chemnitz; *Bulimus*, Scopoli, 1777, this generic name being employed for certain of the species by Bruguiere; Volute (*Voluta* Linn., 1758), by Dillwyn; *Partulus*, Beck, 1837; and *Partula* by Pfeiffer, W. H. Pease, O. Semper, W. G. Binney, and our author. In the first of these brochures the author gives a catalogue of the known species, with authorities for specific nomenclature, and indicates also the remarkable synonomy of the genus. He divides all the forms into the *auriform* and *bulimoid* divisions, each of which seem to be sufficiently well marked. The major part of the work is devoted to the erection of sub-genera, having more or less claim to consideration. The characters of these several sub-genera are succinctly stated, accompanied by a figure of the species used as its type. It is a matter of regret that the author has adopted for a sub-generic nomenclature so many mythologic names, originally applied to Roman deities of more or less note. In this, however, he follows the example of the illustrious founder of the genus, and in view of the great beauty of the forms he studied may well be pardoned. However, it must be admitted that the use of names embodying, in some sense at least, the sub-generic characters would much aid the student. The number of sub-genera erected is fourteen, among which the species are very unequally distributed.

The second of these papers is one of the most valuable contributions to the literature of Partula yet made, inasmuch as in it the author has incorporated numerous full notes on synonomy

[1] A Catalogue of the Genus Partula, Ferussac. By W. D. Hartman, M. D. Printed for the author by E. S. Hickman, West Chester, Pa., 1881. Also,

Observations on the species of the Genus Partula, Ferussac, with a Bibliographic Catalogue. By William Dell Hartman, M. D. Bull. Mus. Comp. Zoöl. Vol. IX. No. V. pp. 171–196. With two maps, Dec. 1881.

and geographical distribution. The facts pertaining to the latter phase are further illustrated by two maps, showing the distribution of the species by islands, and in individual islands. They are, the author states, the work of Mr. Andrew Garrett, a resident of Huaheine, from whom we are promised further descriptions of species based upon the MSS. of the late W. H. Pease, and his own copious collections. From the facts brought out by Dr. Hartman it appears that Partula illustrates the influence of environment as do but few other genera of land shells. It is true that some of the species are said to be remarkably uniform in specific character and somewhat widely distributed over the islands in which they do occur, but the instances of variation, when away from the centers of distribution, appear to be much more numerous. To this fact must be attributed some of the vast quantity of synonomy indicated. Another peculiar feature is the common occurrence of hybrids amongst certain forms "*the result of the union of proximate species.*" Dr. Hartman states that hybridization even occurs between the arboreal and ground species, and here is another fruitful source for re-description, as in Achatinella, and we might add Goniobasis as found in the southern United States, there is a marked mutation of species consequent on change of food and station. "It often happens that the gravid females are washed by heavy rains from a favored position to drier levels, where after a few generations the progeny become depauperated, and so stunted in size as to be mistaken for distinct species." In this connection it might be proper to call attention to certain helices of the United States, *e.g. Zonites friabilis*, *Z. caducus*, *Z. capnodes*, *Z fuliginosus*, and *Z. lævigatus*, which, without doing violence to any racial principle, may be perhaps considered extreme geographical varieties. A fact calling for deep regret in connection with American conchology is the utter neglect of authors thus far, in studying the habits, the food, and the distribution of certain forms. We are convinced that a vast deal of work remains to be done in this direction; a work which Hartman has performed for Partula; a work which will sensibly limit the number of accepted species. Especially will this be true of the two great fresh-water families of our country, Unionidæ and Strepomatidæ. In the case of Partula, Dr. Hartman finds the lingual dentition to vary within rather wide limits in the same species, a fact which apparently indicates that the basis for final and ideal classification *does not lie therein.* It is to be hoped that his unrivaled facilities will induce this author to further elaborate the data bearing on the evolution of forms, of which he now gives us vague but suggestive hints. In summing up we should not fail to remark that of one hundred and seventy-four species enumerated, all go into synonomy save seventy-three, or over fifty per cent. The genus, by the way, is declared to be confined to the Pacific islands. "They have never been found at the Sandwich

group, or New Caledonia; its western limit is New Guinea, and they are not found in New Zealand or Australia. North of the equator, they are found at the Pelew islands, and as far north as Tuam in the Ladrone islands. The New Hebrides and Solomon's island have afforded a few species," while the *metropolis* is situated in the Polynesian islands. Woodward, who makes, with others, the genus a section under Bulimus, gives its distribution as "Asiatic, Australian, and Pacific islands, South America."—*R. Ellsworth Call.*

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GENERAL NOTES.

BOTANY.[1]

An Active Desmid.—I have been much interested lately in observing a species of desmid, *Cosmarium botrytis*. When in bright sunlight it has a slow rotary movement, turning successively from right to left and from left to right, with now and then (if my eyes did not deceive me) what might be called a spasmodic jerk. The play of the protoplasm within the plant-body is exceeding rapid, resembling, in the words of some writers, "the swarming of bees." There seems to be three centers of movements among the granules in each half of the desmid, but as to this I am not quite positive.

I have never seen the revolving motion of the plant excepting when in the full glare of the sun, even when it gave evidence of being alive by the movement of its protoplasm. I call attention to this because in the few books of reference accessible to me, I find no mention of a *revolving* desmid.—*Eloise Butler, Minneapolis, Minn.*

The Coffee-leaf Fungus one of the Uredineæ.—In an interesting paper in the January number of the *Quarterly Journal of Microscopical Science*, H. M. Ward describes and figures all the known stages of the coffee-leaf fungus *(Hemileia vastairix)* of Ceylon, and demonstrates its affinities with the ordinary Uredineæ, Puccinia, Uromyces, Melampsora, etc. When Berkeley described it in 1869, he considered it to be " with difficulty referable to any recognized section of fungi," and regarded it as intermediate between the old group Mucidines and the Uredineæ. Abbay and Morris subsequently came to the conclusion that the bodies considered to be spores by Berkeley, were sporangia, thus entirely unsettling for a time all previous notions as to the relationship of the parasite.

The gross anatomy of the coffee-leaf fungus is thus described by Dyer (*Qr. Jour. Mic. Sci.*, April, 1880): " To the naked eye

[1]Edited by Prof. C. E. Bessey, Ames, Iowa.

the first appearance of the Hemileia is indicated by a slight transparency or palish discoloration, easily noticed when the leaf is held up to the light. These transparent spots indicate the points where infection of the leaf has begun. As the spots becomes larger and older, it assumes a faint yellow color; ultimately on the under side of the leaf, it becomes covered with a bright yellow dust, and this later on changes to a bright orange."

Ward studied the development of the parasitic hyphæ in these spots, and found that after ramifying between the leaf-cells, from which they draw nourishment by means of haustoria (Fig. 1), they develop in great numbers in the lacunæ beneath the stomata, through which they finally protrude. The apex of each hypha expands into an ovoid sac, which eventually acquiring a thickened, roughened wall, becomes a spore (see Fig. 2), the uredospore, according to Ward. Later the same mycelium gives rise in a very similar way to smooth napiform bodies—the teleutospores (Fig. 3).

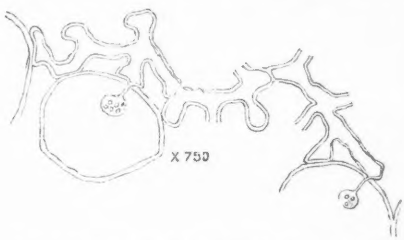


FIG. 1.—Portion of a hypha with haustoria penetrating leaf-cells.

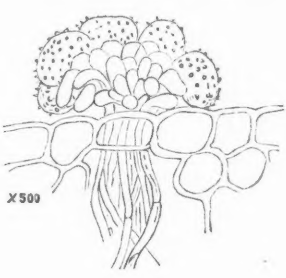


Fig. 2.

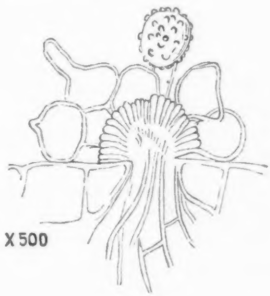


Fig. 3.

FIG. 2.—Vertical section of leaf through a cluster of uredospores. FIG. 3.—Vertical section of a leaf through a cluster of teleutospores; one uredospore still remains.

The germination of the uredospore (Fig. 4 *a*) agrees with that of the uredospore of ordinary Uredineæ, one or more hyphæ being sent out from it, which eventually penetrate the leaf. This was repeatedly seen in the many excellent cultures made by Mr. Ward. The teleutospore germinates very readily, it being the rule for it to do so while yet attached to its hypha. A tube (the

promycelium) is sent out (Fig. 4 *b*) which becomes septate, and eventually bears sporidia (erroneously called *conidia* by Mr. Ward). In this the resemblance to the corresponding process in Puccinia, Uromyces, etc., is so great as to leave little doubt as to the identity of the teleutospores of Hemileia and those of the Uredineæ. It is

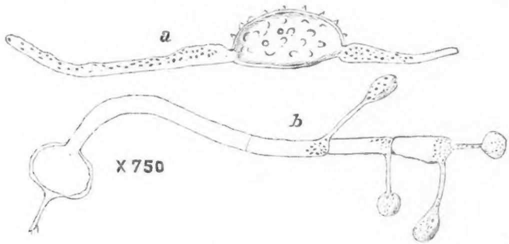


FIG. 4.—*a*, germinating uredospore; *b*, germinating teleutospore bearing four sporidia.

a significant fact that although the sporidia were readily germinated, they soon shriveled up and died, and this took place even when the culture was made upon living coffee leaves. The probable explanation of this is to be sought in the heterœcism of the Uredineæ; it will be well, therefore, for those who are investigating this parasite to direct their attention to the discovery of the alternate host. May it not be possible that *Hemileia vastatrix* has but recently fixed itself upon the coffee-plant, and that the latter is capable of serving for its host in only two of the stages of the parasites? Indeed, may not the query be entertained here whether the heterœcism of the Uredineæ, so particularly noticeable in those species which affect the grasses, is not simply the sort of transition stage in the change of habitat of the parasite from one host to another?—*C. E. B.*

POPULARIZING CRYPTOGAMIC BOTANY.—One of the hopeful signs in the botanical world, so far as we in this country are concerned, is that some of our masters in certain lines of research are writing in simple English about the lower plants. Dr. Halsted's paper, "Fungi Injurious to Vegetation," read before the Conn. Board of Agriculture, and published in the last report of the Board, is a model worthy of being followed by many others. In this paper spurred rye, the potato rot, the wheat rust, the corn smut, the onion smut, the black knot, the apple-leaf fungus, the peach curl fungus, the American grape mildew, the lettuce mildew, and the raspberry fungus, are discussed in a very instructive and entertaining way. It is astonishing how much can be said—and accurately said too—in simple English, if the subject matter be well understood by the writer or speaker. A second admirable example of the treatment of a subject so recon-

dite as to be generally avoided even in botanical classes, is found in Dr. Rothrock's "Captive Plants," which appeared in *Our Continent*, of April 5. The substance of Schwendener's theory as to the nature of lichens is clearly set forth in a manner which leaves nothing to be desired. It is interesting to note that the article is written from the standpoint of Schwendener's view, that is, that a lichen is primarily an ascomycetous fungus parasitic upon certain algæ, the latter being the green bodies known as gonidia. Seven excellent figures accompany the article.

ABNORMAL SPATHES OF SYMPLOCARPUS.—The past spiing I have been on the lookout for abnormal growths in *Symplocarpus fœtidus* Salisb., and herewith transmit the result, trusting that it may lead to further investigation.

I found on examining several hundred specimens, five containing one spathe within another. They were, to all outward appearance, in a normal condition, but contained an inner spathe having a short peduncle (see Figs. 1 and 2). In a cluster of three spathes, one was single, one contained a single perfect inner spathe with a spadix, while the other contained a double inner spathe with one spadix. The double spathe faced toward the rear of the outer spathe. In the single spathes I found specimens facing to the front, to the rear, and to one side.

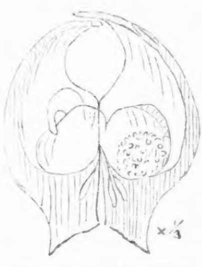


FIG. 1.—Double spathe, laid open to show inner spathe and spadix.

FIG. 2.—Vertical section of a spathe containing an inner spathe with spadix.

I also found three spathes containing abortive spadices. In one case the spathe was three inches in height and contained a minute spadix one-eighth of an inch high upon a short peduncle. This small spadix was yellowish white in color, hollow, and of a spongy consistence. It contained minute undeveloped flowers (see Fig. 3).

FIG. 3. — Vertical section of spathe containing abortive spadix.

Now comes the question as to what causes the malformation in one case and the abortion in the other. Thomé says: "As poverty of soil leads to abortion, so an unusual increase in the development of the axial or foliar organs is the result of too powerful nutrition." This, however, is not a satisfactory explanation. There could not have been enough difference in the plant food near the roots of these plants (often crowded together) to produce these differences. Nearly all the specimens were found growing upon rich loam or muck which had never been under cultivation.—*Chas. S. Plumb, Amherst, Mass.*

Ellis' North American Fungi.—When, in 1878, the first century of "North American Fungi," by J. B. Ellis, appeared with the timidly expressed hope of its author that the work might be continued until a thousand species had been distributed, but few of the subscribers dared hope for a speedy completion of the first decade of centuries, and doubtless most looked for an early suspension of the work. So many attempts have been made to furnish sets of fungi, mosses, lichens, algæ, etc., etc., which have been abandoned long before completion, that subscribers to such sets scarcely expect any other conclusion. It may be that Mr. Ellis will weary of the good work he is doing so well, and thus add his "North American Fungi" to the long list of incompleted exsiccati, but present indications are hopefully to the contrary. Already we have nine centuries, although scarcely more than four and a half years have elapsed since the beginning of the work. The publication of a century every half year involves an amount of labor and a degree of patience and perseverance which only those who have attempted to make up sets of plants can fully appreciate. The two centuries (VIII and IX) which came to hand the middle of April, fully maintain the previously high reputation of the series. Like their predecessors, they include representatives of most of the orders of the fungi, the Hymenomycetes and Pyrenomycetes, however, predominating. No. 775 is *Diatrype tremellophora* Ell., which was critically described in the March Naturalist of the present year, under the caption of *Diatrype disciformis* Fr. Excellent specimens of this curious species are given showing every stage. We shall look with interest for the tenth century, and hope in due time to see Mr. Ellis bravely undertake the second thousand.

ZOÖLOGY.

Preliminary Classification of the Brain of Crustacea.—The following provisional grouping of the brain of Crustacea appears to be justified by known facts, although excepting the brains of Decapoda and Limulus, no special histological work has been accomplished.

The terms archi-cerebrum and syn-cerebrum have been proposed by Professor Lankester, the first to designate the simple worm-like brain of Apus, and the second to designate the composite brain of the Decapoda, etc.

Syn-cerebrum
- Decapoda.
- Tetradecapoda.
- Phyllocarida.
- Cladocera.
- Entomostraca.

Archi-cerebrum
- Phyllopoda.
- Merostomata (Limulus).
- Cirripedia?

The syn-cerebrum of the Tetradecapoda, Amphipoda and Iso-

poda, judging by Leydig's figures[1] and our own observations on that of Idotea and Lerolis,[2] is built on a different plan from that of the Decapoda. The syn-cerebrum of the Phyllocarida is somewhat like that of the Cladocera and Copepoda (Calanidæ); being essentially different from that of the majority of the Malacostracous Crustacea. The Copepodous brain is an unstable, variable organ, but on the whole belongs to a different category from the syn-cerebrum of other Neocarida.

We have, then, probably two types of archi-cerebra, and three types of syn-cerebra among existing Crustacea.—*A. S. Packard, Jr.*

THE COLORING OF ZOO-GEOGRAPHICAL MAPS.—Having had occasion to prepare a colored map to illustrate the geographical distribution of the phyllopod Crustacea of North America, for Hayden's 12th Annual Report of the U. S. Geological Survey, we would propose for the consideration of zoölogists, the following scale of colors, which we have adopted. In the colored maps already published, one by Mr. W. G. Binney on the Western Mollusks, and one by Dr. John L. LeConte to illustrate the distribution of the Coleoptera, the coloring does not at all agree. It is highly desirable that such maps should, if possible, be uniform, as much so perhaps as geological maps.

Arctic Realm	Very pale carmine.
Boreal (Canadian) Province	Blue.
Eastern (Atlantic) "	Pale yellowish-green.
Antillean Region	Deep green.
Central Province	Pale (Vandyke) brown.
Western (Pacific) Province	Sepia, dark brown.
Central American Region	Yellow ochre.
Annual Isothermals	A deep red heavy line.

This combination of colors seems appropriate to the nature of these regions. The pale carmine is like ice; the blue, yellowish-green and deep green characterizes the wooded portions of the continent, and the light brown forms the treeless plains and plateaus of the West. The Alpine summits of the White mountains and Rocky mountains are concolorous with the Arctic regions, and the summits of the Alleghanies with the Boreal province.—*A. S. Packard, Jr.*

PROFESSOR E. A. BIRGE ON THE FIRST ZOEA STAGE OF PINNOTHERES OSTREUM.—In the summer of 1878 I accompanied the Johns Hopkins Laboratory to Cresfield, Md., and occupied my time with study on the development of decapod Crustacea. I was so fortunate as to obtain from the egg specimens of the first zoëa of Pinnotheres, and so unfortunate as to be unable to rear them beyond the first molting. I therefore send figures of the zoëa in

[1] Tafeln zur Vergleichenden Anatomie. Von F. Leydig. Tübingen, 1864, folio.

[2] Zoölogy for High Schools and Colleges, Figs. 255, 256. Drawn by Mr. Kingsley.

order that future observers may be able to connect the free larvæ with the proper adult form.

The female was found in an oyster with the eggs already well

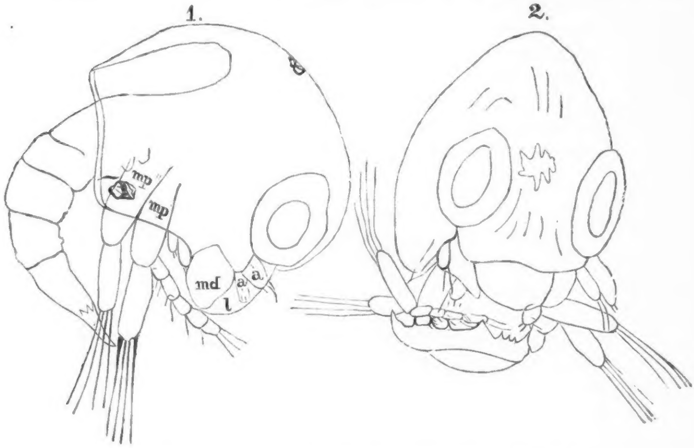


FIG. 1.—Zoea of *Pinnotheres ostreum* (Say) from side. *a'*, antennule; *a*, antenna; *l*, labrum; *md*, mandible; *mp' mp''*, maxillipeds. FIG. 2.—Zoëa from front.

developed. She was put into a large glass jar and given an oyster shell under which to hide, and so lived for more than two weeks. During that time her shell increased greatly in thickness and strength—a fact of which I was made aware by a sharp nip

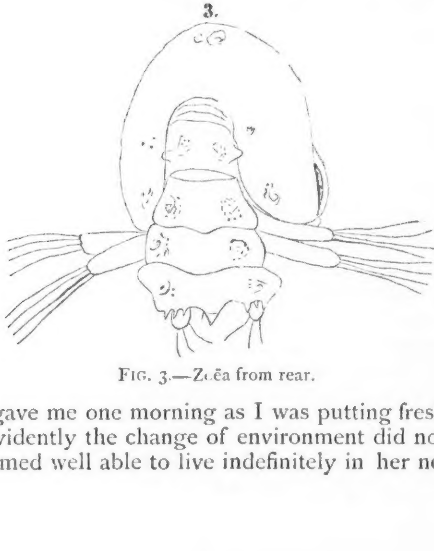


FIG. 3.—Zoëa from rear.

which she gave me one morning as I was putting fresh water into the jar. Evidently the change of environment did not injure her and she seemed well able to live indefinitely in her new quarters.

The eggs all hatched in the course of one night, throve for some days, but died before the first molting, in spite of all possible care.

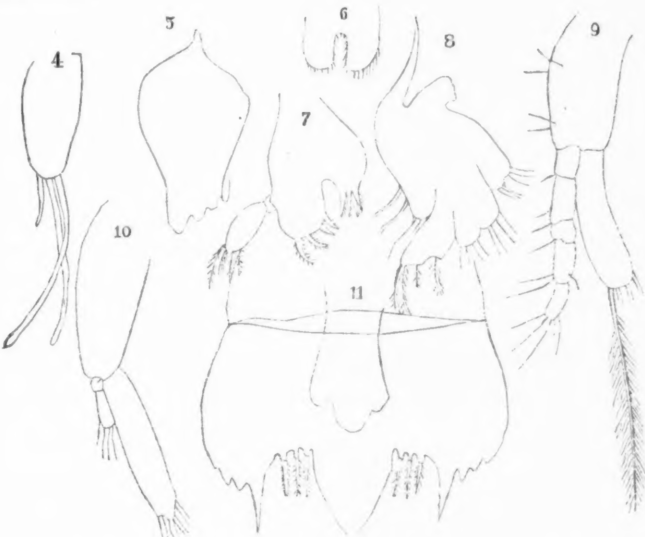


FIG. 4, antennule; 5, mandible from outside; 6, labrum; 7, 1st maxilla; 8, 2d maxilla; 9, 1st maxilliped; 10, 2d maxilliped; 11, end of abdomen.

No special description is needed for the zoëa further than to say that the total length was about 1½^{mm}. No special drawing of the rudimentary antenna was made. The cuts are all traced from camera lucida sketches.

BOPYROIDES LATREUTICOLA, A NEW SPECIES OF ISOPOD CRUSTACEAN PARASITIC ON A GULF-WEED SHRIMP.—Amongst a bottle of marine Crustaceans caught with a fine net out of Sargassum or gulf-weed, near Beaufort, N. C., by Mr. Geo. E. Woodruff, of Brooklyn, N. Y., in October, 1881, I selected eleven specimens of *Latreutes ensiferus* Stm.,[1] having a lateral thoracic protuberance, for the purpose of examining them for Bopyridæ.

The swelling out is very peculiar, being directed outward and forward in looking at the host from above; a front view of the protuberance does not exhibit the star-shaped drawing as in *Bopyrus palæmoneticola* Pack., on *Palæmonetes vulgaris* Stm., owing to the fact that in the present case the female of the para-

[1] *Latreutes ensiferus* Stimpson, Proceedings Acad. Philad., 1860, p. 27.
Hippolyte ensiferus, Milne Edwards in Histoire Naturelle de Crustacées, 1837, Vol II, p. 374.
Bulletin of the Essex Inst., Salem, Mass., 1878, Vol. x, List of North American Crustacea, sub-order Caridea, by J. S. Kingsley, p. 56, No. 16.

site is not at all pigmented. The position of the latter is exactly the same as in Bopyrus, the dorsal side being directed toward the gills of the host and the ventral side toward the swollen carapace of the same.

The examination of our parasite revealed an isopod crustacean belonging to the sub-genus Bopyroides established by Dr. Wm. Stimpson,[1] being closely allied to both the genus Bopyrus and Gyge.[2]

The female of our parasite measures $1\frac{4}{5}^{mm}$ in length and 1^{mm} across its widest diameter. It is not as flat but more of a globular shape than Bopyrus, its integument also less chitinized, the whole body therefore softer. The body is unsymmetrical in shape, similar to Bopyrus, differing also in this respect from the genus Gyge, which is unsymmetrical anteriorly only. Dorsally the segments of the pleon, or tail, are distinct, whereas in Bopyrus they are fused or connate in the central dorsal axis. In this respect it agrees with Gyge as well as in some respects concerning the form of the gills. The latter do not consist of short, thick, fleshy, transversely placed lobes, but of fleshy, roundish ridges attached within the ventral lateral extremity of the six segments of the pleon.

Seven pairs of legs (pereiopods) are developed on one side and only one pair on the opposite side, the remaining six being obsolete through parasitism. They are similar to those of *Bopyrus palæm.*, but even less distinct and not pigmented centrally. The side having but one leg is curved outward.

The marsupium or breeding cavity is bounded posteriorly by the transverse prolonged lamella of the last pereiopod, anteriorly by the cephalic piece and the lamellæ of the first pair of pereiopods, laterally on one side by the fleshy longitudinal ridge along the other developed pereiopods, which are, if I see rightly, there without lamellæ. On the opposite side, where only the first pereiopod remained, the marsupium is covered by two fleshy, sparsely pigmented lamellæ (Figs. 1 and 2 *a, a*), and three or four very thin and delicate broad membranes (Figs. 1 and 2 *b*). The membranes and lamellæ are evidently the prolonged margins of the thoracic segments.

The eggs measure 0.12^{mm} in diameter. There are scarcely more than sixty eggs in some marsupia, the greater part of marsupia containing but a few eggs. On account of the scarcity of material but little was done to study the eggs; they were all in the earlier stages of development, without any pigmentation and of a yellowish color.

The cephalic portion, or head, consists apparently of but one triangular fleshy piece. I was somewhat surprised to find in the

[1] See *Bopyroides acutimarginatus* Stm., in Proceed. Acad. Nat. Sciences, p. 165, Vol. xv, 1863.

[2] Emilio Cornalia and Paolo Panceri in Mem. Acad. Reale di Torino, Ser. 2, Tom. xix, p. 85, Turin, 1861. Also Bate and Westwood, II, p. 223.

otherwise very degenerate female a pair of pigment spots of irregular shape, the eyes, a pair of very minute, short, anterior,

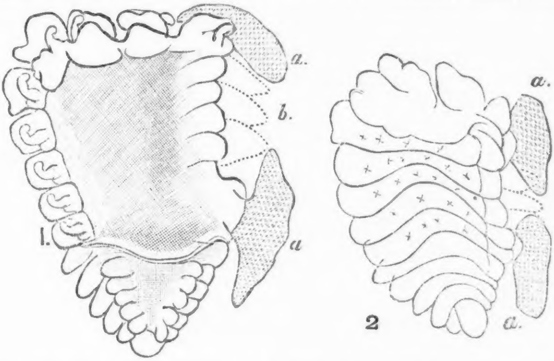


FIG. 1.—Ventral view of female. *a, a,* fleshy marsupial lobes; *b*, membranous extensions of pereion, drawn shorter than in reality. FIG. 2.—Dorsal view of female with lobes *a, a,* on the opposite side in nature from Fig. 1.

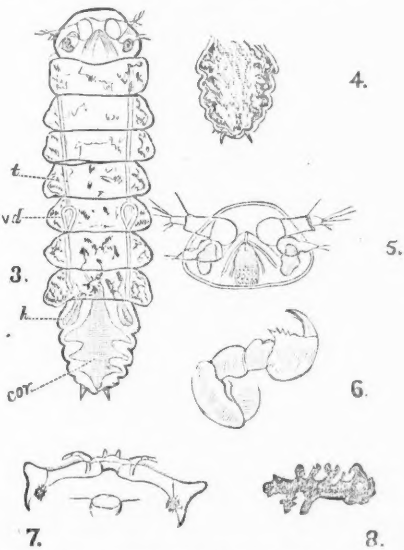


FIG. 3.—Ventral view of transparent male, legs omitted. *A*, pleon without pigment; *t*, testis; *vd*, vas deferens; *h*, liver; *cor*, heart. FIG. 4.—Pleon with pigment of male. FIG. 5.—Head of male. FIG. 6.—Thoracic leg of male. FIG. 7.—Cephalic piece of female. FIG. 8.—Pigment spot of first pereiopod near its lamella of the female Bopyroides.

and a pair of two (three ?) jointed, larger, posterior antennæ (Fig. 7).

The maxilla, if I properly recognized it, consists of a small flat basal piece with a rounded subtriangular flat terminal piece.

The first pair of pereiopods is provided, near the junction of its basal piece and the prolonged lanceolate lamella, with a conspicuous large peculiar pigment spot, as seen in Fig. 8.

The male of our Bopyroides is smaller but higher specialized than that of *Bopyrus palæmoncticola.* It is always found on the same spot—on the ventral side between the breathing appendages of the pleon of the female. It measures $\frac{4}{5}^{mm}$ in length, and nearly $\frac{1}{5}^{mm}$ in width. It is but sparingly pigmented and therefore very transparent.

The head is slightly longer than the first segment of the pereion. Two moderately large pigment eyes are situated a little behind the middle of the head. I have examined five individuals and found in every case the anterior pair of antennæ larger (three-jointed) than the posterior pair (two-jointed). The oral parts are conical and not very distinct.

The first thoracic segment is sub-quadrate, the second to sixth segments are equal in length, width and shape, so is the seventh segment, but with a faint lateral emargination. The propodus of the seven pairs of legs (eight in Bopyrus, male) is sub-chelate with its inferior margin dentate, the dentation not being equally developed in all the legs.

The pleon, or tail, of the male is narrower than the pereion, has six sub-segments, sixth sub-segment with a lateral short spine, an indication of which is also found on the margin of the preceding two sub-segments. The spines may be regarded as rudimentary pleopods.

The heart can be distinctly seen in the pleon, also a narrower string extending laterally from the first to the fifth thoracic segment, where an indistinct twist occurs, after which the string is somewhat flatter, reaching down into the seventh segment, where its terminus is obliterated by pigment. The part of this string anterior to the twist, I regard as the testis, while the posterior may be the *vas deferens.* I did not observe an anastomosis between the two lateral strings, nor have I distinctly seen the anterior terminus of the same. An elongate lobe can be noticed in the first sub-segment of the pleon, which Dr. Fritz Müller also observed in the male of *Bopyrus resupinatus*,[1] and which is regarded by him as the liver.—*Carl F. Gissler.*

Zoological Notes.—The Bulletin of the U.S. National Museum No. 11, is devoted to a Bibliography of the Fishes of the Pacific Coast of the United States to the end of the year 1879, by Theodore Gill.—— New birds from the Sandwich Islands, and a new species *(Asio portoricensis)* from Porto Rico, are described by Mr. R. Ridgway, in the Proceedings of the U. S. National Museum, who also contributes a list of the old world birds

[1] Jenaische Zeitschrift fuer Med. und Naturwis., VI, I, p. 53, 1870.

in the Museum, and notes on Costa Rican birds.——A new genus of deep sea fishes (*Benthodesmus*) from the Banks of Newfoundland, is also described by Messrs. Goode and Bean, while Messrs. Jordan and Gilbert describe thirty-three new species of fishes from Mazatlan.——To the same serial Dr. Shufeldt contributes remarks on the osteology of the glass snake (*Opheosaurus ventralis*). ——The Proceedings also contains Mr. Dall's description of certain limpets and chitons from the deep waters off the eastern coast of the United States.——At a recent meeting (April 18), of the London Zoölogical Society, Professor Flower read a paper upon the mutual affinities of the animals composing the order of Edentata, in which the usual binary division into Phyllophaga (or Tardigrada) and Entomophaga (or Vermilingua) was shown not to agree with the most important structural characters. These, according to the interpretation put upon them by the author, indicates that the Bradypodidæ and Megatheriidæ are allied to the Myrmecophagidæ, and also, though less closely to the Dasypodidæ, all the American forms thus constituting one primary division of the order, from which both the Manidæ and Orycteropodidæ of the old world are totally distinct.——A communication was also read from Mr. Charles Darwin, introducing a paper by Dr. Van Dyck, of Beyrout, on the modification of a race of Syrian street dogs by means of natural selection.——Mr. O. Thomas likewise read an account of a small collection of mammals from the State of Durango, Central Mexico, in which examples of several northern forms, not hitherto recorded so far South, and several southern forms not hitherto known so far North, occurred.——In an essay on certain points in the morphology of the Blastoid crinoids, Messrs. Etheridge and Carpenter discuss in a way preliminary to their larger forthcoming work, some points which will interest our western palæontologists.——Dr. J. Gwyn Jeffreys continues in the Proceedings of the Zoölogical Society his account of the deep sea mollusks procured during the *Lightning* and *Porcupine* Expeditions in 1866–70.——In the Bulletin of the U. S. Fish Commission, Mr. J. A. Ryder has a very interesting paper on the Protozoa and Protophytes considered as the primary or indirect source of the food of fishes. He has also found that the food of the very young shad consists almost entirely of very small crustaceans, the very youngest Daphnidæ, etc. Larger shad swallow small larval Diptera, besides Entomostraca. He says that the mode in which the young fish capture their entomostracan prey may be guessed from their oval armature. Most fish larvæ appear to be provided with small, conical somewhat backwardly recurved teeth on the jaws. "Rathke in 1833 described the peculiar hooked teeth in the lower jaws of the larvæ of the viviparous blenny, and Forbes has observed minute teeth in the lower jaw of the young *Coregonus albus*. I have also met with similar teeth in the lower jaw of the larval

Spanish mackerel." The mouth of the adult shad is practically toothless, and multitudes of small copepods are caught in the meshes of its branchial arches.——The new Acalephs from the Tortugas and Key West, and also from the east coast of New Zealand are described and well illustrated by Mr. J. W. Fewkes in the Bulletin of the Museum of Comparative Zoölogy. Vol. x. Nos. 7 and 8.

ENTOMOLOGY.[1]

REPELLING INSECTS BY MALODORANTS.—Mr. J. A. Lintner, State Entomologist of New York, has recently published an interesting paper, in which (assuming that the parent insect is guided to her food-plant, or to that destined for her offspring by the sense of smell), he advocates the use of strong-smelling or malodorous substances, as counter-odorants to prevent noxious species from laying their eggs on cultivated plants This theory is put forth as a "new principle, in protection from insect attack."

As remarked in a notice of the paper elsewhere, we have one serious criticism to make of it, viz: that it lacks both proof and substantial foundation in fact. To give force to the theory, Mr. Lintner has to assume that substances like kerosene, coal-tar, naphthaline, carbolic acid, gas-lime, bisulphide of carbon, smoke, etc., repel by their odor; whereas the ordinary belief that they repel because of their toxic properties seems to us far more reasonable. Our attempts to prevent the oviposition of the Cotton-worm moth, the Colorado potato-beetle, the apple-tree borers, and the Plum curculio, by the odor of carbolic acid and of coal-tar, of infusions of Ailanthus, Walnut, and decoctions of Horehound, or cabbage worms by the odor of creosote, have proved unavailing. Those of others in the same direction, and notably of Mr. I. W. Taylor, of Poland, N. Y., with such pungent odors as musk, camphor, spirits of turpentine, asafœdita, kerosene, etc. (*Rural New Yorker*, Nov. 2, 1872), used especially to prevent the oviposition of *Pieris rapæ*, equally failed of the intended result; so that, so far as experience will warrant an opinion it is adverse to the "new principle." The senses of sight, touch, and taste, which are more palpable and readily located, play their part in insect economy, and both experiment and observation would indicate that, except perhaps for certain special families, particularly of Lepidoptera, this part is greater than that represented by the sense of smell, even in guiding the female to lay her eggs.—*C. V. Riley.*

HABITS OF BITTACUS APTERUS.—Baron Osten-Sacken communicates in the *Wiener Entomologische Zeitung* (May number, p. 123) an interesting note on the above named Neuropterous insect, which is not rare in open grassy places in parts of California. He states that the insect replaces the want of wings by a great dex-

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

terity in climbing, swinging itself, monkey-like, from halm to halm, often suspended only by the front tarsi. One specimen was observed devouring a Tipula, and if this Dipteron should be the usual food of the Bittacus, the existing mimicry between the two insects would be significant, and in this particular case the more so as the Californian Tipula has, at least in the male, only rudimentary wings. According to Mr. H. Edwards's observations both species are frequently found in the same localities.

STRANGE HABIT OF METAPODIUS FEMORATUS Fab.—The "thick-thighed metapodius" is a common insect in the Southern cotton fields, attracting attention by its buzzing flight and ungainly form. The numerous observers connected with the cotton insect investigation have observed it preying upon the cotton caterpillar, while Glover states that it has been observed to injure cherries in the Western States. Mr. Schwarz informs me that he has seen it sucking the moisture from the newly dropped excrement of some unknown bird. Its eggs, according to Glover, are smooth, short, oval, and have been found arranged around a pine-leaf like a bead necklace.

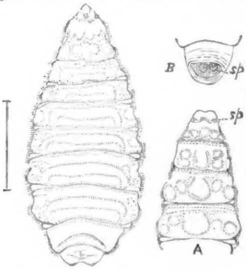
In May of the present year, while studying the Northern army-worm *(Leucania unipuncta)* in the wheat fields near Huntsville, Alabama, I found that among the other new natural enemies which this Southern irruption occasioned the Metapodius was very conspicuous. Immediately upon entering the fields I was struck with its buzzing flight, and it was not long before I discovered one flying with an army-worm impaled upon its beak. Watching its flight I soon saw it alight in the line of May-weed *(Maruta cotula)*, which surrounded the field, and hastening to the point, found it busily engaged in sucking the blood of the captured worm. I was about to step closer and bottle the specimen, when it began to crawl down the branch upon which it had alighted, with that ridiculously slow and majestic motion peculiar to Reduvius and other Heteropters, until it reached a crotch where it dropped the shrivelled corpse of the worm so that it hung exactly suspended. Up to this time I had been so interested in watching this individual that I had not looked about me closely, and now I was surprised to find that the whole long line of May-weeds was fairly garnished with the empty skins of Leucania larvæ, each one hung with great nicety in some crotch. This same field I visited for three successive days, and in that time there was quite a perceptible increase in the number of the worms so placed. The sight of these suspended larvæ was certainly one of much interest, and, without seeing the great bug at work I might have puzzled over it for a long time without any satisfactory explanation.

I shall not attempt to explain this curious procedure on the part of the Metapodii. It is seemingly as unexplainable as the somewhat similar habit of the Southern loggerhead or shrike in

impaling insects and other small animals upon thorns and sharp twigs. The worms are useless as further food, and certainly cannot be used as nidi for the eggs of the destroyer.—*L. O. Howard.*

HABITS OF COSCINOPTERA DOMINICANA.—Large numbers of the larvæ and pupæ of this case-bearing beetle were recently found by Professor F. H. King, at River Falls, Wis., in a large ant hill. In our account of the earlier stages of this beetle (6th Mo. Ent. Report, pp. 127–130), the larvæ, which we succeeded in feeding with old dry leaves, etc., were raised from the egg and their natural habitat remained, therefore, unknown. We have no doubt from Professor King's experience that it is an inquiline in ants' nests, especially as other species of this group, *e. g.*, the European *Clythra quadrisignata*, are known to have this habit. No North American species of the *Clythra* group has heretofore been known to live among ants, though we lately received numerous cases of a *Clythrid* larva, found in ants' nests in Arizona, by Mr. H. K. Morrison, indicating, by their peculiar form and sculpture, a species (or perhaps genus) allied to *Coscinoptera dominicana* whose larva presumably feeds upon the vegetable débris in the ant hill. What benefit the ant derives from its presence it is difficult to perceive.—*C. V. Riley.*

BOT-FLY MAGGOTS IN A TURTLE'S NECK.—The Museum of Brown University has received specimens of a bot-fly maggot, of which eight or ten were taken, according to Professor J. W. P. Jenks, from under the skin of the back of the neck, close to the shell of the box turtle *(Cistudo carolina).* The turtle was collected at Middleboro, Mass. Fig. 1 represents the larva magnified three times, seen from beneath, *a* the anterior part of the body seen from above, and *b* the spiracles (*sp*) at the end of the body.



It appears to be a genuine bot-fly, but quite unlike any genus figured by Brauer in his work on the Œstridæ.

The body is long and slender, cylindrical, tapering so that each end is much alike. The segments are provided with numerous fine spines, which are not entirely confined to the posterior half or two-thirds of the segment. The body is slenderer and the spines much smaller than in *Gastrophilus equi.*—*A. S. Packard, Jr.*

SUN-SPOTS AND INSECT LIFE.—Mr. A. H. Swinton, in a communication to *Nature* (April, 1882, p. 584), gives a condensed table intended to show the relation existing between sun-spot cycles and the appearance of insects. A number of Lepidoptera that are rare in Great Britain, and at the same time so conspicuous as to not easily be overlooked, are selected for this purpose.

That there exists a relation between sun-spot periods and meteorological phenomena, and as a consequence between such insect phenomena as depend on meteorological conditions, will scarcely be doubted; but we do not believe that any such connection can be proved from the recorded capture of certain species even in a country like England, which, entomologically, is so thoroughly explored. However that may be, his table shows that the maximum appearance of the species enumerated follows the years of the minimum of sun-spots, and *vice versa*.

A Mite Infesting a Pork-Packing House.—I send you by this mail a few specimens of a mite which I do not identify by means of the literature in my reach. It is found in a pork-packing house here and seems to develop from the livers, lungs, and kidneys after they have been cooked and dried by steam. They are treated in this way to reduce to a fertilizer. Where this material lies in sacks on the floor the mite is found forming a layer half an inch thick in places.

If you are familiar with it will you be kind enough to send me its name on the enclosed card?—*W. E. Wilson, Professor Natural Science in Coe College.*

This mite proves to be *Tyroglyphus longior* Gervais, and this is the first occurrence of this species in the United States so far as we are aware.

Larvæ of a Fly in a Hot Spring in Colorado.—I send you a bottle containing four specimens of animal life new to me, and those to whom I have shown them. Having no works of reference I would respectfully ask you to describe them for me. They were found in Gunnison Co., Col., in a hot spring, temperature 157° F., attached to the rock by the long end at about an angle of 45° and continually moving. Having no alcohol they were put into strong alum water. The color has not materially changed. The rocks were covered with them, as well as in other springs which were examined. Any information regarding them will be thankfully appreciated.—*H. G. Griffith, 317 N. 4th street, Burlington, Iowa.*

The larvæ are of those of a species of Stratiomys, and are like those from Borax lake, California, described and figured by us in the American Journal of Science, February, 1871, p. 102. The specimens received from Mr. Griffith are much larger than those from Borax lake, and differ decidedly in the much longer and narrower terminal, anal segment; this segment in the Borax lake species is half as wide as long, with a radiating tuft of respiratory filaments; in the present species it is nearly four times as long as wide, and tapers to an obtuse point, with a transverse opening, and it is provided with minute short respiratory filaments. The head is as in the Borax lake specimens, but the body is a little more flat, and spindle-shaped, being broader in

the middle and tapering more rapidly towards each end. It is of a dark horn brown. Length 37^{mm}, breadth $5\frac{1}{2}^{mm}$.—*A. S. Packard, Jr.*

DESCENT OF DYTISCUS DURING A SHOWER.—In the October No. of Vol. 3, *American Entomologist*, mention is made of a "veritable shower" of water-beetles, supposed to be a species of *Dytiscus*, as having occurred in a certain locality in Kentucky during the summer of 1880. I am reminded of this phenomenon by the singular manner in which some of my friends came into possession of two remarkably fine specimens of *Dytiscus fasciventris* Say. Just after one of our light September showers, a goblet, that had been left on the outer ledge of a window, was found pretty full of the fresh rain-water in which were swimming about, in apparent content, the two water-beetles referred to.

How they came there was the question—the opinion prevailing that they "rained down." They could not have bred within a considerable distance from the house where they alighted, and the fact that they dropped into the glass of water was also most singular. They made no attempt to escape from the glass and lived there until the water was frozen late in November. No food was given them except that the water was occasionally replenished. Is it known to be a habit of this insect to rise into the air at certain times on the approach of, or during the progress of a shower?—*Mary E. Murtfeldt, Kirkwood, Mo.*

ANTHROPOLOGY.[1]

A WELL MERITED HONOR.—It will be a source of gratification to the many friends of Professor Charles Rau, the Nestor of American archæologists, to learn that the University of Friburg has conferred upon him the honorary title of Doctor of Philosophy.

A CORRECTION.—In looking over the contents of the last number of the *American Antiquarian*, we were astonished to find that Dr. Yarrow, who has come to be our standard authority on dead Indians, should turn aside to treat of the superstitions of *live* Indians. We have the doctor's permission to state that his paper in the *Antiquarian* was upon the superstitions of the Sioux Indians.

THE WASHINGTON SATURDAY LECTURES—By the joint action of the Anthropological and the Biological Society of Washington, in February last, a course of eight free lectures at the National Museum was organized. Four of them were upon anthropology and its kindred topics, with the following titles: March 18—What is Anthropology? by Professor Otis T. Mason; April 1—Outlines of Sociology, by Major J. W. Powell; April 15—Paul Broca and the French School of Anthropology, by Dr.

[1] Edited by Professor OTIS T. MASON, 1305 Q. street, N. W., Washington, D. C.

Robert Fletcher; and April 29—How we see, by Dr. Swan M. Burnett. The lectures of Mason, Powell and Burnett were on topics somewhat familiar to our readers. They are all published separately by Judd & Detweiler, and will appear in a volume when the course is completed. On account of the freshness of the subject and the great care bestowed upon the production, the lecture of Dr. Fletcher deserves more than a passing notice. The avowed object of the speaker was to state, not what is anthropology, but "the reason of its existence, and the circumstances attending its establishment and recognition in the scientific world." A brief reference is made to separate branches of the study even in classic times, but the origination of the science as a whole is taken from the foundation of the Paris Society of Anthropology, some twenty-three years ago (1859). The associations devoted to kindred branches and to anthropology, are:

La Société des observateurs de l'homme, Paris. 1800.
La Société philanthropique, Paris. 1803.
The Society for the protection of Aborigines, London. 1838.
La Société Ethnologique de Paris. 1839.
The American Ethnological Society. 1842.
The Ethnological Society of London. 1844.
La Société d'anthropologie de Paris. 1859.
Versammlung der Anthropologen in Göttingen. 1861.
The Anthropological Society of London. 1863.
The Anthropological Institute of Great Britain and Ireland. 1871.
La Sociedad de anthropologia de Madrid. 1865.
The Imperial Society of anthropology and ethnology, Moscow. 1866.
Berliner Gesellschaft für Anthropologie, &c. 1868.
Anthropologische Gesellschaft in Wien. 1870.
Societa italiana di antropologia, &c. 1871.
The Anthropological Institute of New York. 1871.
Academy of Sciences, Cracow, Poland. 1877.
The Anthropological Society of Washington. 1879.
Deutsche Gesellschaft für Anthropologie, Ethnologie und Urgeschichte. 1870.
Congres international d'anthropologie et archéologie préhistorique. 1865.

The publications of these societies are also indicated.

The biography of Broca is drawn mainly from the article of Professor Pozzi in the *Revue d'Anthropologie.* Broca, among his many talents, had a great deal of ingenuity for devising mechanical helps. Among those noticed are the *craniograph*, the *new goniometer*, the *stereograph*, *cadre à maxima*, *micrometric compass*, *occipital goniometer*, *cranioscope*, *porte-empreinte intra-cranien*, *endograph*, *millimetric roulette*, *endometer*, *sphenoidal crochet*, *optic sound*, *pachymeter*, *turcica crochet*, *craniosphore*, *craniostat*, *facial demi-goniometer*, *auricular goniometer*, *flexible bi-auricular square*, *cyclometer*, *facial median goniometer*, *orthogon*, *goniometer of inclination*, *flexible goniometer* and *tropometer*.

Paul Broca was the founder of the Société d'Anthropologie de Paris (19th May, 1859), the *Revue d'Anthropologie*, the Laboratory of Anthropology, and the Ecole d'Anthropologie, united in the Institute d'Anthropologie. The total number of his printed

articles and volumes is 534, of which 109 are on comparative anatomy and general anthropology, 48 on general craniology, 35 on special craniology, 27 on ethnology, and 19 on miscellaneous subjects.

As mentioned above, the Saturday lectures can be procured from Judd & Detweiler, of Washington, at 75 cents for the volume containing the whole course.

GEOLOGY AND PALÆONTOLOGY.

LESQUEREUX ON THE TERTIARY FLORA AS RELATED TO THE TERTIARY ANIMALS OF THE WEST.—In regard to Professor Cope's recent papers on the Cretaceous and Tertiary groups of the Western Territories, Mr. Lesquereux writes us that he has carefully examined his conclusions and must say that he approves them fully and that they agree well with his own. "As to the Laramie group, while I call it Eocene, Cope must decide according to the animal remains. I must stick to the plants. The difference is only in name and it will be better understood hereafter. For the so-called Green river group, I have always found a great difference of type between the plants of Green river station, including Alkali station, and those of White river, Florissant and Elko. I therefore readily admit, as I have already done, two different stages of this group, as indicated by the plants. A lower one for Green river station and Alkali and an upper stage for that of White river, so far we agree.

"But now let us see what the Miocene will say. From the Laramie group upwards there is already a number of permanent types recognized in subsequent formations. There is a marked identity between the plants of the Laramie group and those of the Union group, and then between those of the last group and White river, we find the Lower Miocene very clearly characterized, then follows the Middle Miocene or the Carbon and Alaska groups, and then the upper Miocene or Pliocene of the Chalk bluffs of California. All these facts considering the character of the plants, constitute by persistent species a continuous flora which it is extremely difficult to separate. Indeed if we admit that all the plants described from the Union group represent the same geological stage, we can scarcely draw any lines of separation for the Tertiary, which continues uninterruptedly from the Eocene of Black Butte and Golden City to the flora of our present epoch. Thus our present living flora would appear quite as Cretaceous in some of its characters as that of Golden City.—*F. V. Hayden.*

THE GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.—The Report of Progress of this Survey for 1879–80 forms a bulky octavo, accompanied by five maps of the regions explored, and illustrated by nineteen plates. The work of the Geological corps in 1880 embraced surveys in the Northwest Territories, Manitoba,

Quebec, New Brunswick, Nova Scotia and the Magdalen islands. The report embodies the results of an exploration from Fort Simpson on the Pacific to Edmonton on the Saskatchewan, conducted in 1879 by Dr. Geo. M. Dawson, with maps containing all the available information regarding a region of about 130,000 square miles. The Skeena river is the most important stream of British Columbia north of the Fraser, with the tributaries of which its affluents interlock. About 2000 Indians of the Tshimsian and and Tinneh stocks are the sole inhabitants of the region. The Douglas fir or "Oregon pine" finds its eastern limit near McLeod's lake, which empties into the Parsnip, a branch of Peace river. The area of actually cultivable land on this river is estimated at 23,500 square miles. The fossil plants of the Peace river district represents a flora akin to that of the Dakota of the United States, and is the oldest in which broad-leaved exogens of similar types to those existing predominate. Dr. Dawson appends some valuable notes on the distribution of some of the more important trees of the region, such as the Douglas fir *(Pseudotsuga Douglasi)*, which attains occasionally a height of over 300 feet, and frequently surpasses eight feet in diameter; *Tsuga Mertensiana*, the western hemlock, which near the coast attains a height of 200 feet, *Thuja gigantea*, which on the coast not unfrequently surpasses fifteen feet in diameter and 100 to 150 in height, and other conifers of smaller size. Extensive lignite deposits exist in the Tertiary on the Souris river, and among the fossil plants of this district are *Platanus nobilis* (Newberry), the leaves of which are a foot in diameter, a *Sequoia*, and a sassafras.

Dr. Robert Bell contributes an interesting report upon Hudson's bay, and some of the lakes and rivers to the west of it. This body of water, no part of which is in the Arctic circle, and the southern extremity of which is south of London, measures about 1000 miles in length to the end of James bay, is over 600 miles in width, and has an area of about 500,000 square miles, or upwards of half that of the Mediterranean. Its drainage basin extends eastward to the center of Labrador, and westward to the Rocky mountains, while southward it is extended by the Winnipeg basin, emptying by the Nelson river, as far as latitude 45°. It thus includes nearly 3,000,000 of square miles, a great part of which enjoys a temperate climate, while large tracts are very fertile. About thirty rivers of considerable size flow into Hudson's bay. The Albany and the Churchill have the longest courses, but the muddy Nelson, though only 400 miles long, discharges the greatest body of water. The Albany can be navigated by shallow draft steamers for 250 miles, the Nelson for 70 or 80, while the Churchill, a beautiful clear-water stream, somewhat larger than the Rhine, has at its entrance a splendid harbor. Geologically Hudson's bay lies within the Laurentian, the Winnipeg division excepted. To the south and south-west of James

bay much of the land is good; to the south-west the country is well wooded, and valuable minerals, including iron-stone, galena, gypsum, petroleum-bearing limestone, etc, are known to exist. The land around Hudson's bay is rising from five to ten feet in a century. It is not improbable that, possessing a sea-port in the very center of the continent, 1500 miles nearer than Quebec to the fertile lands of the Northwest territories, Hudson's bay may prove the future highway between those territories and Europe.

This portion of the report concludes with a memoir upon the northern limits of the principal forest trees of Canada; a list of thirty-eight species of fossils collected in Manitoba, principally cœlenterates, brachiopods and gasteropods; a list of 261 species of plants collected at various spots around Hudson's bay in 1880, and a catalogue, by Dr. J. L. LeConte, of the coleoptera collected between Lake Winnipeg and Hudson's bay. Other appendices are devoted to the mollusca, the analysis of the waters of Hayes' and Nelson rivers, and weather statistics.

The Magdalen islands are thirteen small islands in the Gulf of St. Lawrence, inhabited principally by French Acadians, and capable of becoming an unrivaled sea-side resort on account of the clean sandy beach backed by rich greensward.

Absence of Ancient Glaciers in Eastern Asia.—In an article on glaciers and glacial periods in their relations to climate, in *Nature*, A. Wœikof refers to the fact that the great interior plateaux of Central Asia are too dry for glaciers. China, Mandchooria and Amoor are destitute of glaciers owing to the want of moisture in the winter time, dry north-west winds then prevailing. This has been the case since the Pliocene period. Pumpelly and Richthofen found no traces of ancient glaciers in China nor on its western and northern borders, neither did Dr. Schmidt find any in the Amoor. As to the plateaux of Central Asia, they must have been exceedingly dry since the rise of the Himalaya and Karakoram to the south and the Pamir heights to the west of them, and thus have had nothing corresponding to the later glacial periods of Europe and North America.

A New Genus of Tæniodonta.—*Tæniolabis sulcatus*, gen. et sp. nov. *Char. gen.*—This genus is established on a tooth whose position is on the arc of the alveolar line which connects the molar and middle incisor regions. It is probably either the third incisor of the superior or inferior series, or the canine of the inferior series. In either case it differs from the corresponding tooth of any known genera of *Tillodonta* or *Tæniodonta*. The long diameter of the root being placed antero-posteriorly, that of the crown makes with it an angle of 30°.

Section of the crown oval; the grinding surface scalpriform in the manner of a rodent incisor; but beveled on side of the long diameter instead of on the end as in that order. Enamel con-

sisting of a wide band on the external side of the tooth, which embraces more of the circumference near the apex than elsewhere. Apex grooved behind.

If this be an inferior canine tooth it differs from that of the *Tillodonta* in its large size and incisor-like form. It most resembles the external or third inferior incisor of *Calamodon*. From this it differs in the scalpriform wear, and the oval instead of triangular section, and in the absence of cementum layer.

Char. Specif.—The enamel band does not cover the entire width of the external face, but leaves exposed a part of the dental surface anterior and posterior to it except at the apex. At the latter point there are seven coarse shallow grooves of the enamel surface; the posterior of these split up below, and become narrowed, while the anterior run out at the more curved anterior edge of the enamel band. The posterior apical groove has a flat bottom. At the front of the apex the enamel is involute to the inner side for a short distance. The inner face of the tooth displays five facet-like bands of the dentinal surface, which soon disappear inferiorly.

Measurements.—Length of tooth (root restored) .058; length of enamel band .031; width of enamel band at middle .0095; diameters of middle of tooth, anteroposterior .0130, transverse .009 long; diameter of apex of tooth .008.

This tooth indicates a new and interesting type, perhaps of *Calamodontidæ*, and one of which more information will be awaited with interest. Judging from the size of the tooth its possessor was as large as a sheep. From the Puerco Eocene of New Mexico, from D. Baldwin.

GEOLOGICAL NEWS.—The Philosophical Transactions of the Royal Society of London, 1880, contains Part x of Professor W. C. Williamson's researches into the organization of the fossil plants of the coal measures. The memoir is illustrated by eight plates. Certain small objects with projecting spines from the coal measures have been described as radiolarian, but Professors Haeckel and Strasburger concur with the writer in believing them vegetable. There is strong cause for the belief that they are cryptogamic macrospores, and Professor Strasburger suggests that their nearest allies may possibly be *Azolla* and other rhizocarpous genera.——In the same transactions Professor Owen gives a description of some remains of an extinct gigantic land-lizard (*Megalania prisca* Owen) a contemporarary in Australia with correspondingly large marsupials, also now extinct. Megalania possessed upon its skull several horns, provided with osseous cores. The principal of these horns correspond with those of the living small Australian lizard, *Moloch horridus*, but the horn-cones of the latter are formed of fibrous corium, without bone-deposits. The skull is 1 foot 10½ inches wide. The premaxillaries are eden-

tulous and sheathed with horn. The creature seems to have been phytophagous, and its defensive weapons probably preserved it until it finally fell before the Australian so-called "Aborigine." The memoir is illustrated with several plates.——The Geological Magazine, April, 1882, contains contributions to the palæontology of the Yorkshire oolites, by W. H. Hudleston. This is one of a series, and treats of the Gasteropoda. The zones which contain Gasteropoda are the Dogger, with *Nerinæa cingenda* and numerous other shells; the Millepore bed; the Scarborough or gray limestone; the Kelloway rock, with numerous *Trigonias;* the Oxford clay; and the lower Calcareous grit. Estuarine beds separate the lowest four of these. In all the beds the Cephalopoda are more conspicuous than the Gasteropoda. In the same magazine are "Some Points in the Geology of Anglesey," by Dr. Roberts, forming part of a discussion respecting the nature of certain beds; figures and descriptions of some fossils from the red beds of the Lower Devonian, Torquay, by R. Etheridge; a note on *Homalonotus Champernowni*, by H. Woodward, with a figure of the tail; remarks on the classification of the European rocks known as Permian and Trias, by the Rev. A. Irving; a continuation of W. Flight's history of meteorites; and the concluding part of the life of Linnarson, by Professor Chas. Lapworth. Mr. Irving's paper is a review of the arguments respecting "Permian," as it was named by Sir Roderick Murchison. In Germany these rocks are known as the Dyas, and consist of "two series of strata sharply distinguished from each other, both petrographically and palæontologically," as remarked by Professor Credner, of Leipzig. The argument will be continued in the next number. Mr. Mudd suggests that what is known to engineers as "water-hammer action" may come into play as a factor in producing the phenomena of earthquakes and volcanoes.——At a recent meeting of the Geological Society of London, Mr. D. Macintosh remarked upon some additional discoveries of high level marine drift in North Wales.——Professors King and Rowney have recently published a work with a title too long to transcribe, upon ophites in general and *Eozoön* in particular. The reviewer of this work in the *Philosophical Magazine* states that the structures figured by the authors have only a rough general resemblance to those claimed to be organic.——In the *American Journal of Science*, Professor J. D. Dana continues his series of articles upon the flood of the Connecticut River valley from the Quarternary glacier. Writing of the retreat of the glacier, he gives a most interesting account of the present condition of Greenland, with a shaded map of its surface. In the same periodical Ben. K. Emerson describes the dykes of micaceous diabase that penetrate the bed of zinc ore at Franklin Furnace, N. J., and M. W. Iles treats of the occurrence of vanadium in the ores at Leadville. Mr. C. A. White explains the continuity of genetic

lines of gill-bearing fresh-water mollusca, now separated from each other by barriers of land and sea that they are incapable of passing, by showing that the rivers in which kindred forms occur, once formed part of the drainage of inland lakes that have since become obliterated, and thus there was formerly a continuity which is now destroyed.——Chas. U. Shepherd follows with a notice of Monetite and Monite, two new minerals obtained from the twin islands Mona and Moneta, near Porto Rico, W. I. Both are phosphate of lime, formed in the caverns of limestone rock by the infiltration of the soluble ingredients of the bird-guano upon the surface.——Dr. Lemoine has communicated to the French Academy the result of his late palæontological researches upon the mammals of the Eocene beds around Rheims. The study of cerebral casts of *Arotocyon* and *Pleuraspidotherium* show relations to the embryonal brains of living mammals, and to those of certain marsupials, since the cerebral hemispheres leave the quadrigeminal tubercles completely uncovered. The dentary formula of *Pleuraspidotherium* and *Plesiadapis* recalls that of certain Australian phalangids. M. Lemoine has formed the genus *Adapisorex* to include some very small mammals, equally related to the Phalangidæ, found by him in the environs of Rheims. ——The Proceedings of Acad. Nat. Sci. Phil., contain Part II. of a revision of the Palæocrinoidea, by Chas. Wachsmuth and F. Springer. This extensive paper occupies 238 pages, and is illustrated by three plates. It is devoted to the families, Platycrinidæ, Rhodocrinidæ, and Actinocrinidæ. Two species of *Batocrinus*, and three of *Eretmocrinus*, all from the Burlington and Keokuk limestones of Indiana and Iowa, are described. In the same Proceedings, Angelo Heilprin has a "Revision of the Cis-Mississippi Tertiary Pectens of the United States;" "Remarks on the Molluscan genera *Hippagus*, *Verticordia*, and *Pecchiola*;" a "Note on the Approximate Position of the Eocene Deposits of Maryland," in which those deposits are referred to a horizon nearly equal to that of the Thanet sands and London clay of England and the Braccheux sands of the Paris basin, that is, near the base of the Eocene series; and a "Revision of the Tertiary species of Arca."

MINERALOGY.[1]

PROCEEDINGS OF THE MINERALOGICAL SECTION OF THE PHILADELPHIA ACADEMY OF NATURAL SCIENCES.—The second number of the Proceedings of the Mineralogical and Geological Section of the Academy of Natural Sciences has just been published. The first number was published in 1880, and contained the Proceedings from 1877 to 1879, inclusive, consisting of fifty-one articles, a number of which have been noticed in foreign periodicals.

[1]Edited by Professor H. CARVILL LEWIS, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

This society, founded in January, 1877, and consisting of between fifty and sixty members, is the only society in the country especially devoted to mineralogy which publishes Proceedings. A large proportion of the communications are brief and of local interest. It is greatly to be desired that a society of larger scope—a *Mineralogical Society of America*—may be organized ere long. With the leading mineralogists of this country as active members, such a society should be at least as successful as the mineralogical societies of Great Britain and of France. The NATURALIST will give such a society all possible assistance.

The volume before us consists of thirty-seven communications upon mineralogy and geology, contributed during 1880 and 1881. The mineralogical articles are here briefly reviewed under the titles as given.

Some new Pennsylvania mineral localities.—Chas. M. Wheatley reports new localities for aurichalcite, melaconite, byssolite and azurite in Berks and Montgomery counties.

Pseudomorphs of Serpentine after Dolomite.—H. Carvill Lewis describes at length some serpentine pseudomorphs from the Wissahickon creek, which have the cleavage planes and external characters of dolomite, resembling those described by Professor Dana from the Tilly-Foster iron mine. Their mode of origin is discussed.

New localities for Barite.—H. C. Lewis gives three new Pennsylvania localities for barite.

New localities for Chabazite.—L. Palmer announces two new localities for chabazite in Delaware county, Penna.

On a new ore of Antimony.—H. Carvill Lewis describes a new ore of antimony from Sonora, Mexico. It has the following characters: Isometric. Habit octahedral. Generally massive. Hardness 6.5–7. Spec. grav. 4.9. Luster of the crystals, glassy; of the massive mineral, sub-resinous or sub-vitreous. Color, pale grayish-yellow. Streak uncolored. Transparent in crystals, opaque when massive. Fracture sub-conchoidal. Before the blowpipe fuses with difficulty to a gray slag, decrepitates strongly and gives a white coating. In the closed tube decrepitates strongly, turns yellow when hot, gives off water but does not fuse. It contains 3.1 per cent. of water, and consists mainly of antimonious oxide. (This communication was made Feb. 23, 1880, six months before Professor Cox's paper before the A. A. A. S. upon this same mineral. Professor Cox supposes it to be stibiconite, but it is more nearly allied to senarmontite.

Menaccanite from Fairmount park.—John Ford exhibits a large curved crystal of this mineral from Fairmount park, Phila.

Note on Damourite from Berks county, Penna.—F. A. Genth describes a shaly, talcose mineral from Rockland Forges, Pa., an alkali determination of which gave him: H_2O, 5.60; K_2O, 10.32; Na_2O, 0.36.

On the Stalactites of Luray cave.—A. E. Foote describes the cave near Luray, Va., and states that the curving and twisting of the stalactites was due to the fungi which grew upon their surface, and so caused lateral growth of carbonate of lime.

New localities for Gypsum.—H. C. Lewis reports Easton, Penna. and Richmond Coal-field, Va., as new gypsum localities.

New locality for Sphene.—A. E. Foote describes the new locality for sphene at Egansville, Renfrew county, Canada, where crystals weighing from twenty to eighty pounds occur in a vein of apatite. A crystal of apatite weighed 500 lbs.

A new locality for Hyalite.—H. C. Lewis describes green hyalite from Germantown, Pa.

Note on Autunite.—H. C. Lewis gives the optical characters of the Philadelphia autunite. It is orthorhombic, with an optic axial divergence of 24°.

Crystalline cavities in Agate.—Theo. D. Rand exhibits specimens of agate containing crystalline cavities once occupied by calcite crystals. The method of taking type-metal casts of these cavities was explained.

Note on Halotrichite.—H. C. Lewis states two localities for halotrichite.

On twin crystals of Zircon.—A. E. Foote records the discovery of twin zircon crystals at Egansville, Canada.

Disks of Quartz between laminæ of Mica.—Theo. D. Rand exhibits circular disks of quartz, showing a rotating black cross in the polarizing microscope, which occur in muscovite from Amelia county, Va.

On two new localities of Columbite.—H. Carvill Lewis records the occurrence of columbite at Mineral Hill, Pa., and at Dixon's Quarry, Del. The crystallographic characters of the specimens were described.

On the occurrence of Fahlunite near Philadelphia.—H. C. Lewis states that he has found fahlunite at two localities in hornblendic gneiss near Philadelphia. It is of a pale apple-green color, and has a scaly structure and felspathic cleavage. It resembles the variety known as chlorophyllite, and appears to be a product of alteration.

On a mineral resembling Dopplerite from a peat bed at Scranton Pa.—H. C. Lewis describes the black jelly-like substance from the Scranton peat bed, already noticed in the NATURALIST.

Titaniferous Garnet.—H. A. Keller describes a black garnet from Darby, Pa., whose color is due to enclosed particles of menaccanite and sphene, as shown both by microscopical examination and by chemical analysis.

Pyrophyllite and Alunogen in coal mines.—E. S. Reinhold states that the coatings of pyrophyllite from the coal slates of Mahanoy City, already described by Dr. Genth, have now been found in four collieries. Other coatings have proved to be alunogen, the origin of which is discussed.

New locality for Mountain Cork.—T. D. Rand finds this mineral near Radnor, Pa.

New locality for Aquacreptite.—G. H. Parker finds aquacreptite in decomposed gneiss in West Philadelphia.

Note on Aquacreptite.—H. C. Lewis remarks that at each of the localities for aquacreptite the rock differs; at West Chester it is serpentine, at Marble Hall limestone, and at Philadelphia gneiss. Experiments are described which he had made to discover the cause of decrepitation, which he finds due to capillary attraction. He concludes that the mineral is of mechanical origin, and differs from bole merely in a greater amount of mechanical action when placed in water, and that it is therefore not entitled to a special name.

Quartz crystals from Newark, Del.—W. W. Jefferis finds doubly terminated quartz at this locality.

A new mineral from Canada.—A. E. Foote draws attention to some olive-green crystals from Hull, Canada, which he supposes to be new.

A peculiar twinned Garnet.—W. W. Jefferis exhibits a twinned garnet where the smaller crystal fitted loosely in a cavity in the larger.

On Diorite.—E. S. Reinhold describes a diorite from Placer county, Cal., closely resembling the "Napoleonite" of Corsica.

A new locality for Allanite.—Isaac Lea finds allanite with zircon at Yellow Springs, Chester county, Pa.

A new locality for Copiapite.—E. S. Reinhold finds copiapite at Mahanoy City, Pa.

On Phytocollite.—H. C. Lewis describes more fully the mineral from Scranton, giving an analysis, and suggests the term phytocollite as generic for the related jelly-like hydrocarbons found in peat.

A NEW LOCALITY FOR HAYESINE.—N. H. Darton[1] has found hayesine in soft fibrous crystals coating datholite and calcite in cavities in the trap of Bergen Hill, N. J. An analysis gave

CaO	BO_3	H_2O		
18.39	46.10	35.46	=	99.95.

The slender crystals were grouped together, and lay like little white mats upon the calcite crystals. This is an interesting occurrence of hayesine.

THE THIRD APPENDIX TO DANA'S MINERALOGY (Wiley & Sons, N. Y.).—Professor E. S. Dana has done a great service to mineralogists in the careful preparation of a volume bringing our knowledge of mineralogical species up to the present time. Since the last appendix was prepared, seven years ago, a large number of new species have been added, and much mineralogical work has been done. The present appendix contains descriptions of

[1] *Amer. Journ. Sc.*, June, 1882, p. 458.

about 300 species announced as new, and also refers to many mineralogical articles, quoting new analyses and new facts as to physical characters and localities. The appendix is designed to make Dana's Mineralogy (5th ed.) complete up to January, 1882, and should be in the hands of every owner of that noble volume.

ORTHITE FROM VIRGINIA.—F. P. Dunnington[1] and G. A. Koenig[2] have described and analyzed orthite from Amelia county, Va. It occurs in blade-like crystals several inches long, of a black color and pitchy luster, sometimes enveloped by an altered material. It has the following composition :

	SiO_2	Al_2O_3	Fe_2O_3	Ce_2O_3	La_2O_3	Di_2O_3	FeO	MnO	CaO	K_2O Na_2O	H^2O	
(1)	32.35	16.42	4.49	11.14	3.47	6.91	10.48	1.12	11.47	.46	2.31	= 100.62
(2)	32.90	17.80	1.20	8.00(CeO_2)	14.20		10.04	1.	11.32	—	3.20	= 99.66

Analysis (1) is by Dunnington, (2) by Koenig.

NEW ANALYSES OF COLUMBITE AND MONAZITE.—F. P. Dunnington[3] gives the following analyses of the columbite and monazite of Amelia county, Va.:

Columbite. Hardness 5.5 ; spec. grav. 6.48; luster sub-resinous; color dark-brown, streak light-brown, red when in thin splinters.

Ta_2O_5 Nb_2O_5	SnO_2	MnO	FeO	CaO	MgO	Y_2O_3 (?)	
84.81	trace	8.05	5.07	1.27	.20	.82	= 100.22

Monazite.

Ce_2O_3	Di_2O_5	La_2O_3	Y_2O_3	Fe_2O_3	Al_2O_3	ThO_2	P_2O_5	SiO_2	
16.30	24.4	10.3	1.1	.9	.04	18.6	24.04	2.7	= 98.38

OBITUARY.—William S. Vaux, a well-known amateur mineralogist, died at Philadelphia on May 5th, in his 71st year. As vice-president of the Academy of Natural Sciences and of the Numismatic and Antiquarian Society, as president of the Zoölogical Society and as treasurer of the American Association for the Advancement of Science, he showed an active interest in the progress of science.

The chief object to which he devoted his ample means was the collection of choice minerals, and as a result of extensive traveling and constant collecting throughout a lifetime, he left one of the finest collections in this country. His cabinet was remarkable for the beauty of the individual specimens, in many cases unsurpassed. He has bequeathed it to the Academy of Natural Sciences of Philadelphia.

[1] *Amer. Chem. Journ.*, Vol. IV, p. 138.
[2] Proc. Acad. Nat. Sc. Phila., 1882, p. 103.
[3] Loc. cit.

GEOGRAPHY AND TRAVELS.[1]

The Chukchies and the Kuro-Sivo.—Captain Hooper, lately in command of the U. S. steamer *Corwin*, in an address before the Geographical Society of the Pacific, spoke of the habits and customs of the Chukches who inhabit the arctic coast of Siberia. In the winter they travel west on their way to the Russian trading posts in the interior, which they reach by ascending the rivers west of Cape Jakan; in the spring they travel to East Cape, cross Behring Strait, and continue their journey to Cape Blossom, Kotzebue Sound, where they meet the Eskimo from the entire coast of Arctic Alaska, from Point Barrow to Cape Prince of Wales, for purposes of trade, returning to their houses by the same route in the latter part of the summer.

Captain Hooper is of the opinion that a branch of the Kuro-Sivo, or Japanese warm stream, passes through Behring Strait, but subject to the varying conditions of wind and ice. A southerly wind accelerates it, while a northerly wind stops it entirely for a time; and in some cases of a long-continued northerly wind, it is not impossible that a slight southerly set may be created, but such an occurrence must be rare and of short duration. The current is much stronger in August and September than in the early part of the season when the ice-pack extends entirely across the Behring Sea. This branch of the Kuro-Sivo follows the direction of the Kamchatka coast to the northward through Behring Sea, passing between St. Lawrence Island and the coast of Asia, and thence through the strait, after which it is controlled in a great measure by the condition of the ice-pack. Captain Hooper stated that he had never known the current through the Strait to exceed three knots per hour, the average being probably not more than two knots. Near Herald and Wrangell Islands the current was found setting to the north and eastward about two knots per hour, and no tidal change was detected; off the south coast of Wrangell Island a slight westerly current was observed. In the Arctic, as well as in the Behring Sea, there is no doubt a tidal current, but it is so dependent on the conditions of the ice that only the mean of a long series of careful observations could determine its characteristics.

Six cases containing the zoölogical and anthropological collections, made by the brothers Krause in the Chukchi peninsula, have arrived at Bremen. Dr. Arthur Krause will remain in Alaska during the summer, but his brother is now on his way home.

Geographical Notes.—Mr. A. R. Colquhoun, an officer in the employ of the Government of India, who has spent ten years in surveying and engineering work in British Burma, has undertaken a journey through southern China, and across the frontier through

[1] Edited by Ellis H. Yarnall, Philadelphia.

Burma to Rangoon. He proposes to start from Canton and attempt the ascent of the Si-kiang or Canton river to the highest navigable point, and thence pass through the southern part of the Yunnan province and the Shan states by way of Kiang-hung, Kiang-tung, Zimmay, and Shuaigyeen or Tonghoo, to Rangoon. He expects to travel over one thousand miles of new ground, and to bring back a full description of fifteen hundred miles of country hitherto undescribed. The two great objects of Mr. Colquhoun's adventurous journey are to collect information of permanent value to geographical science, and to gather materials for a journal of travel likely to prove interesting to the general public.——The town of Tokio, Japan, by a recent census was found to contain 1,064,331 inhabitants.——Dr. Crevaux, when last heard from, had reached the sources of the Rio Pilcomayo, S. lat. 21°, W. long. 68° 20′ 15″, in the Republic of Bolivia. Some very important geographical observations had been made in connection by telegraph with the Cordova Observatory.——The *Nature* states that a Russian naval officer has invented a very ingenious apparatus for ascertaining the depth of the sea without the use of a costly and heavy line. Indeed, no line at all is used. The instrument consists of a piece of lead, a small wheel with a contrivance for registering the number of revolutions, and a float. While the apparatus sinks the wheel revolves, and the registered revolutions indicate the depth. When the bottom is reached, the lead becomes detached, the float begins to act, and the machine shoots up to the surface, where it can easily be fished up by a net and the register read off.——The celebrated Indian explorer, Nain Singh, or the Pundit No. 9, is dead. He was one of the most remarkable travelers of this century; his explorations in the Trans-Himalayian regions, and especially in Thibet in the service of the Trigonometrical Survey of India, were most successful and important.——The Rev. W. S. Green has undertaken the exploration of the great glaciers of New Zealand, and the ascent of some of the highest peaks of those islands, several of which have never been attempted. He is accompanied by two well-known Swiss guides. Afterwards Mr. Green proposes to visit New Guinea and ascend Mount Owen Stanley.——Captains Burton and Cameron have been visiting gold deposits in Apollonia and other districts near Axim, west coast of Africa. They were to start for the interior via the Ankobra river on February 25th last. They are making a valuable collection of objects of natural history.——It is thought that the American Mission will fix their station at Bailundo, fifty miles from Bihé, in the center of the region in which the Ganguela language is predominant, and on the line of the densest population towards the center of Africa. ——The following papers were to be read at the German Geographical Congress, which met at Halle on April 11–14: On some scientific results of the voyage of the *Gazelle*, particularly from a

zoögeographical point of view, by Professor Studer (Berne); On the progress of our knowledge of Sumatra, by Professor Kan (Amsterdam); On the alleged influence of the earth's rotation upon the formation of river-beds, by Professor Zöppritz (Konigsberg); On the colonies of Germans and their neighbors in Western Europe, by Herr Meitzen (Berlin); On the historical development of geographical instruction, by Dr. Kropatschek (Brandenburg); On the treatment of subjects relating to conveyance in geographical instruction, by Professor Paulitschke (Vienna); On the introduction of metrical measures in geographical instruction, by Professor Wagner (Göttingen); On the relation between anthropology and ethnology, by Professor Gerland (Strassburg); On the ethnological conditions of Northern Africa, by Dr. Nachtigal (Berlin); On the Polar question, by Professor Neumayer (Hamburg); On the geographical distribution of Alpine lakes, by Professor Credner (Greifswald); On the true definition of the development of coasts, by Professor Günther (Ansbach); On geographical instruction in its relation to natural sciences, by Professor Schwalbe (Berlin); On the Guldberg-Mohn theory of horizontal air currents, by Professor Overbeck (Halle); On the systematic furtherance of the scientific topography of Germany, by Herr Lehmann (Halle).

MICROSCOPY.[1]

MICRO-CHEMISTRY.—In a paper by H. Reinsch on the detection and separation of certain minerals under the microscope, it is claimed that the use of the microscope in chemical analysis is not only rapidly increasing, but that it is approaching the spectroscope and in some respects surpassing it in usefulness. It is admitted, however, that great skill is required in manipulation, and in preparing test objects to verify results, as appearances vary according to the degree of concentration of the solutions used, and different reactions will sometimes be obtained from the same salt. The following are some of the more interesting experiments, as translated in the *Scientific American Supplement.*

"Silica, of all substances, yields the most varied and beautiful forms, resembling plants and ferns, often presenting, in the most glowing colors, five-leaved flower forms in infinite varieties. To obtain these forms, we place a drop of a four per cent. solution of potassium silicate on an object slide, and then add a drop of a two per cent. solution of sodium bicarbonate, and then allow the liquid to evaporate at the ordinary temperature; after a few hours have elapsed the most beautiful flower forms will be found spread over the slide, and will be readily recognized by a pocket lense, but when examined by the microscope with the Nicol at 90°, will exhibit the crystals gleaming with a most magnificent play of colors. By moistening the object with a drop of copal varnish, and covering it with a thin glass, these forms may be permanently

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

preserved. If we mix a drop of the four per cent. solution of the silica solution with a drop of the one per cent. sodium bicarbonate solution, we fail to obtain any plant forms, but find polarized spheres, which, when the Nicol prism is at 90°, exhibit a dark cross, just such as are obtained with calcspar; on further turning of the prism it seemed to revolve visibly, and at 0° almost entirely disappears or passes over into a green cross. The most minute traces of silica can, by this means, be readily detected in a mineral, by melting a small sample of the substance with a little potassium hydrate and dissolving it in a little water, and then placing a clear drop of the solution on an object slide in the manner previously indicated.

It is just as easy to microscopically determine aluminum oxide as it was to detect the silica. It may be recognized as well from its sulphates as from its alkali solutions. If we place a drop of a four per cent. solution on an object slide and allow it to evaporate, spherical crystals will be obtained, which, turning at 90°, show a white cross formed of pencils of rays; if we cover the object with a mica plate, and place the Nicol at 0°, the rays of the little spheres appear as if composed of a number of small black grains; placing it at at 60°, they appear as two blue rays opposite to each other, which at 90° assume a corresponding position, and on further turning of the prism disappear entirely. If we mix a saturated aluminum oxide solution in potassium hydrate with sufficient water to produce a two per cent. solution, and place a drop or two of it on the slide, then mix the sample with a drop of a one per cent. solution of sodium bicarbonate, after evaporation, there will remain a dull white spot, which when still moist shows peculiar spheres; by means of these alumina can easily and positively be distinguished from silica; for they appear when the prism is at 90° as a white cross whose diagonal axis ends in two round or rhombic scales. If we mix the alkali solution of silica and aluminum oxide with a drop of sodium bicarbonate solution, the silica will appear as silvery, partly closed dendrites, while the alumina assumes lengthy forms which, when covered with a mica plate, seems blue, while the dendrites of silica are seldom colored.

Glucina may be very easily distinguished microscopically from both of the preceding earths. A drop of a four per cent. solution of glucium sulphate when evaporated on the slide leaves large stars, which may be detected by the naked eye; whose fern-like leaves spread themselves over the entire surface of the drop. The star in the center, when the prism is at 90°, exhibits prismatic colors, the leaves appear of a dull silver white or brownish color, and they are often perforated.

Boric acids is likewise very easy to detect, for from its two per cent. aqueous solution there is obtained, after evaporation, a series of very small plates hardly 2 mm. in diameter, which, when they are magnified 80 times, do not show any cross. If the residue of

the boric acid be moistened with a drop of the two per cent. solution of sodium bicarbonate, the dried drop will be found to consist of beautiful polarizing spheres, which in their center inclose a small white cross; this on turning the Nicol prism also revolves. Occasionally dendritic stars instead of the spheres are formed.

The alkalies possess such optic properties that they can be definitely and certainly distinguished by the microscope. In making these tests it is best to employ the sulphates for the examination, as they are the most constant in their composition, and in the drying the samples will not absorb moisture from the air and so produce forms which may readily be recognized. Four per cent. solutions were made of the alkalies soluble in water.

The test with potassium sulphate gives, at 0° of the Nicol, a series of rhombic plates, which are not very well defined; at 90° blue rims with yellow or red spots are developed; these cannot be taken for any other alkali.

Sodium sulphate will be recognized just so soon as it becomes dry by its percipitation. In the darker field of the microscope it appears dull, and silvery-white in hopper-shaped quadratic crystals.

The ammonium sulphate assumes such peculiar shapes that it cannot be mistaken for any other salt. At 0° the crystals are hardly recognizable; at 90° they appear like partly decomposed walls built of gray blocks, with blue and brown rims.

Lithium sulphate forms clusters of prismatic needles which at 0° show beautiful colors and a blue cross, which at 90° becomes black. The most minute quantities of lithia can be recognized by their optical behavior.

Lime may be detected in several different ways: if a drop of a two per cent. solution of calcium chloride is mixed with a drop of a one per cent. sodium bicarbonate solution, the drop will become cloudy, and after drying it appears white and shows distinct dendritic stars which consist of an accumulation of small crystals. Barium and strontium salts fail to show this reaction, or only in a very indistinct manner. Lime is best recognized under the microscope when it is in the form of the sulphate, and is prepared by mixing a drop of a soluble lime salt with a drop of sodium sulphate. The sulphate crystallizes in stellar-shaped crystals, which cannot readily be mistaken for any other forms.

Barium nitrate assumes mossy, glistening like silver, colorless dendritic forms; while strontium nitrate takes the form of radiating needles, which are bluish at 0°, and at 90° are blue, green, and red.

Magnesia may, even when present in the most minute quantities, be detected by the microscope. The sulphate forms colorless clusters of needles, which do not become colored even at 90°.

The copper sulphate takes the form of step-like prisms, which

at 0° are almost colorless, becoming at 70° light blue with green stripes, and at 90° show brilliant colors.

The four per cent. solution of manganese sulphate shows broad scales, silver white to gray in color, and which are partly serrated at 0°, as well as at 60° and 90°. If the sample is left by itself for several days, polarizing spheres will appear; these are so peculiar that the manganese can readily be recognized from them, especially as no other metal forms such spheres.

Cadmium presents the most characteristic formations of all the metals; a four per cent. solution of the sulphate produces large spheres containing ellipsoids, which radiate from the center and are marked by regular transverse depressions. This formation can be recognized without a Nicol's prism, and therefore it is not the result of the polarized light, but evidently depends upon the mechanical arrangement of the crystals. On using the Nicol the spheres show at 0° a beautiful blue or green cross, whose color zones increase with the turning of the prism until 90° is reached, when the most beautiful colors of the rainbow are manifested, while the ellipsoid becomes darker, better defined, and the transverse depressions are marked by dark spots. These phenomena become still more characteristic when observed over a plate of mica. From more dilute solutions of the cadmium sulphate, it is possible to obtain the spheres, but the peculiar structure is not observed.

If a two per cent. solution of iron sulphate be mixed with a one per cent. solution of sodium bicarbonate, the drop soon becomes cloudy, and is covered with a gold lustrous film of the oxide; after drying the specimen shows no spheres, but if it is allowed to remain quiet for two days, small crystals of iron carbonate are formed; these show the phenomena of polarization distinctly, but in a very peculiar manner.

Uranium sulphate assumes the most beautiful forms of all the metals; a four per cent. solution is taken, and at least twelve hours are necessary to produce the desired formation. It can readily be recognized with a pocket lens, and resembles beautifully colored asters or corn-flowers. Less frequently it occurs in the form of envelopes with velvet-blue, narrow, and purple-colored broad triangles, which may also be recognized without the Nicol, and therefore are not produced by polarized light but result from the mechanical arrangement of the crystals.

The mercuric sulphate is difficultly soluble, but it can easily be brought into solution by the addition of a few drops of nitric acid. It forms figures similar in shape to a Maltese cross, of superimposed scales, which are very unstable.

Silver may easily be determined, and in such a way that it is not easily mistaken for any other metal. A drop of a two per cent. solution of silver sulphate deposits bright points which may be detected with the naked eye; at 0° these appear as complete

rhombic octahedrons, with the edges cut off; at 90° they glisten with the most beautiful play of colors, like the diamond; at times groups are formed which seem exactly like a set of diamond jewelry.

PROTECTOR FOR OBJECTIVES.—A very convenient and useful contrivance for covering the front surface of an objective, and thereby protecting it from injury from corrosive fluids or gases, and also for enabling the objective to be plunged directly into water so that different layers of the liquid may be rapidly examined for microscopic constituents, or sediments at the bottom examined *in situ*, is made by T. H. McAllister, of 49 Nassau street, New York. Fig. 1 gives an external view of the instrument, and Fig. 2 shows it in section as applied to an objective. It is made of brass and closed at the lower end with a thin cover glass. It is applicable to any objective of sufficiently narrow mounting and long working focus, and it works well with powers from a 1½ inch to a low-angled ¼th or ⅕th.

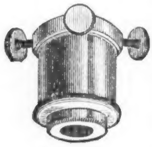


Fig. 1.

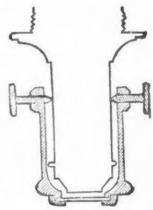


Fig. 2.

LIVING OBJECTS FOR THE MICROSCOPE.—Living specimens of animals and plants are supplied, for microscopical study, by A. D. Balen, of Plainfield, N. J. Single packages are sent by mail for 30 cents, or contracts made for a weekly supply, throughout the season, at a still lower rate.

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SCIENTIFIC NEWS.

— At a meeting of the New England Historic Genealogical Society, held April 5th, Dr. William Barrows read the following memorial to Congress:

"To the Honorable the Senate of the United States:—Your petitioners, the members of the New England Historic Genealogical Society, would respectively represent that there are in the Territories of New Mexico and Arizona twenty-six towns of the Pueblo Indians, so called, in all containing about ten thousand inhabitants; that the number of their towns was once very much greater; that those remaining are the remnant of very ancient races in North America whose origin and history lie yet unknown in their decayed and decaying antiquities; that many of the towns have been abandoned by the decay and extinction of their inhabitants; that many of these relics have already perished, and so made the study of American ethnology vastly more difficult; that the question of the origin of the Pueblos and the age of their decayed cities, and the use of some of their buildings, now magnificent ruins,

constitute one of the leading and most interesting problems of the antiquary and historian of the present age; that relic hunters have carried and scattered wide through America and Europe the remains of these extinct towns, thus making their history's study still more difficult, and in some particulars nearly impossible; that the extinct towns, the only monuments or interpreters of these mysterious races, are now daily plundered and destroyed in an almost vandal way; that for illustration the ancient Spanish cathedral or pecos, a building older than any now standing anywhere in the original thirteen States, and built two years before the founding of Boston, is being despoiled by the robbery of its graves, while its timbers are being used for camp-fires and sold to relic-hunters, and even used in the construction of stables. Your petitioners therefore pray that at least some of these extinct cities or pueblos be carefully selected, with the land reservations attached, and dating mostly from the Spanish crown of 1680, may be withheld from public sale, and their antiquity and ruins be preserved, as they furnish invaluable data for ethnological studies, now engaging the attention of our most learned, scientific, antiquarian and historical students."

— It is proposed by a committee, signed by S. F. Baird, Drs. S. D. Gross, H. C. Wood, Weir Mitchell, Mr. Fairman Rogers, and others, to make a suitable and substantial acknowledgment of the preëminent services rendered to science by Professor Joseph Leidy, who has held the chair of anatomy in the University of Pennsylvania for thirty years, and to provide a testimonial which, while expressing the admiration of those who unite in it for his disinterested and self-sacrificing devotion to science, will relieve him from some elementary teaching and enable him to devote himself hereafter to those fields of profound investigation in which he is unrivaled. It is proposed, therefore, that the sum of $100,000 shall be raised, the interest of which shall be annually paid to Professor Joseph Leidy during his lifetime; and that, after his death, the said income shall be applied in perpetuity to the maintenance of the Joseph Leidy Chair of Anatomy in the University of Pennsylvania. The names of the contributors will be perpetuated in a suitable manner. Subscriptions will be received by Dr. William Pepper, No. 1811 Spruce street, Philadelphia.

— At the request of Dr. Anton Dohrn, Director of the Zoölogical station at Naples, Dr. W. B. Scott has accepted the Honorary Secretaryship for America for the publications of the Naples station. Monographs on the Ctenophores, by Dr. C. Chun; on the genus Fierasfer, by Dr. C. Emery; on the Pantoda, by Dr. A. Dohrn and on the Corallines, by Professor Solms, have already been issued, and a number of others are in preparation. These works are of a high order of excellence, and very fully illustrated. Dr. Simon Syrski, Professor of Zoölogy in the University of Lem-

berg, a well known ichthyologist who discovered the male of the common eel, died January 14, aged 51. Professor A. W. Malm of Göttenberg, Sweden, died March 4, aged 61.

— The death of Professor William B. Rogers, the President of the National Academy of Science, and late President of the Massachusetts Institute of Technology, occurred very suddenly May 30, while delivering the opening address of the commencement exercises of the Massachusetts Institute of Technology at Boston. Professor Rogers was born in Philadelphia in 1805. In 1835 he organized the geological survey of Virginia and conducted it until its discontinuance in 1842. He published numerous papers on mechanics, physics and geology. He was a fluent, elegant speaker and debater, most genial and kindly, hearty, ready and sympathetic in his intercourse with young scientists, and was in all respects a rare and admirable man.

— It is the intention of the writer to publish an account of the spawning season of as many marine forms as possible, with a brief description of the methods of oviposition, places to look for eggs and embryos, and such other details as will aid one in obtaining and recognizing such material as is necessary for embryological work. To this end he would request that all who are working at the development of marine forms would send him notes covering the points in question for which due credit will be given. It is thought that the desirableness of such a paper will be evident to all, and it is hoped that the responses will be numerous. Address all replies to J. S. Kingsley, care Boston Society of Natural History, Boston, Mass.

— Dr. Joseph Szabo, Professor of Mineralogy and Geology in the University of Budapest, Hungary, in a recent letter announces his intention to be present at the meeting of the American Association at Montreal in August. He will start from Liverpool for Quebec in the early portion of July, and will visit as much of our country as possible in the short space of time that he can remain. He is especially desirous of visiting the Yellowstone National park. He is especially anxious to secure a great variety of the igneous rocks of this country, especially those from our Western territories. His writings on the volcanic rocks of Hungary and other portions of Europe are numerous and valuable.

— The French Government is to establish a zoölogical laboratory on the shores of the Mediterranean at Villafranche, near Nice, under the care of Dr. J. Barrois. We have received from Professor Lacaze-Duthiers a brochure giving a full account, with plans, of his prosperous seaside laboratory at Roscoff, and the winter zoölogical laboratory which he has founded at Banyuls-sur-mer.

— Mr. E. W. Nelson has returned from a sojourn of four and a half years in Northern Alaska. Besides his meteorological work, in connection with the U. S. Signal Service, he has brought to Washington an extensive and complete series of specimens, among which are about nine thousand implements and carvings, illustrating the mode of life of the Esquimaux and their handiwork. His notes of their customs, his vocabularies, and his collection of photographs, are very interesting and important. He has also secured a large collection of the birds and fishes of Alaska.

— Among the new fellows elected at the last meeting of the Royal Microscopical Society, says the *English Mechanic*, was Mr. W. A. Thoms, baker of Alyth, who for the past ten years has been engaged in tracing the origin of leaven, which he concludes is identical with the fibrin of gluten and the granular contents of embryo-membranes. Mr. Thoms has also devoted a great deal of time to an investigation of the potato disease, and the salmon fungus.

— Charles M. Wheatley, who was well known for his important discoveries of a Mesozoic Saurian bone-bed near Phœnixville, and of a Quaternary cave in eastern Pennsylvania, containing bones of the Megalonyx, tapir, peccary, etc., died May 6th. Mr. William S. Vaux died in Philadelphia May 5th, leaving a bequest of $10,000 to the Academy of Natural Sciences.

— Among the papers read at the recent meeting of the American Forestry Association, held at Cincinnati, was one paper on forest tree culture in California, and another on the growth of certain California forest trees and the meteorological influences suggested thereby, by R. E. C. Stearns.

— The next meeting of the American Association for the Advancement of Science will be held at Montreal, beginning Aug. 23, under the presidency of Principal J. W. Dawson. A number of British and other foreign scientists will be present, and the meeting will undoubtedly be one of unusual interest.

— Professor Kowalewsky, of Moscow, has gone to the Caucasus to examine the petroleum deposits of that region.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Philosophical Society. Nov. 4, 1881.—Dr. E. R. Heath described his exploration of the rivers Beni and Mamore in Bolivia, illustrating his remarks with maps of the region explored, and giving many particulars relative to the productions of that part of Bolivia.

Nov. 18.—Dr. Brinton explained the substance of his paper on the names of the gods in the Kiche Myth.

Mr. Lesley read a paper from Dr. Newberry on the origin of the Lake basins, and remarked upon the relations of Dr. Newberry's claims to Professor Spencer's discoveries and views. He then gave a sketch of the progress of the excavations at Assos during the last few months, under the auspices of the Boston Archæölogical Society.

Dec. 2.—"Notes on the Laramie group, in the vicinity of Raton, New Mexico," by Professor J. J. Stevenson, was read by title.

Dec. 16.—Mr. Price described the rockery on the grounds of the University of Pennsylvania.

Professor Cope presented two papers of the geological exploration of the Big-Horn region, with special reference to the Eocene period.

PHILADELPHIA ACADEMY NATURAL SCIENCES. Jan. 24.—Mr. Skinner called attention to specimens of *Dryocampa imperialis*, which he exhibited. The insect had reached perfection in the chrysalis stage but had failed to emerge.

Dr. Koenig exhibited a specimen of monosite from the mica mine of Amelia Court House, Va. This monosite contained 25.82 phosphoric acid, 4.22 oxide of thorium, and 69.65 of oxides of cerium, lanthanum, and didymium. The formula derived from this differed from that obtained for North Carolina monosite, and the speaker suggested the possibility of the existence in it of an undetermined metal of the cerium group.

A discussion upon the cause of the timber line on high mountains and of the treeless nature of prairies was carried on, Mr. Meehan stating his belief that water rather than fire was the cause of forest destruction. Messrs. Leidy, Heilprin, Redfield, and Koenig opposed this view.

Dr. Horn spoke upon *Platypsyllus*, a small roach-like beetle parasitic upon *Scalops*, and made by Dr. Le Conte the type of a new family.

Feb. 7.—Professor Heilprin combated the opinion of Professor Sterry Hunt relative to the replacement from the interstellar space of carbonic acid abstracted from the air in the formation of coal of limestone. The speaker held that the limestones of the older geological formations were, like those of our days, formed from those still older, while the amount of carbonic acid stored up in the coal beds of the world would, if again mingled with the atmosphere, only amount to one half of one per cent. of its bulk, or still 3½ per cent. below the quantity necessary to destroy life.

Mr. Ryder described and illustrated the mesoblastic origin of the ribs from cylindrical vacuolated tracts, and the segmentation of the notochord in *Gambusia patruelis*.

Dr. Leidy exhibited specimens of worms from the black bass. They were bright red, 3 to 6 inches long, and lived coiled up in the muscles and other tissues of the fish. The worm is probably

identical with one of the genus *Agamonema*, found in fresh water turtles.

Mr. Potts exhibited a specimen of the sponge to which the unfitness for use of the Boston drinking water had been attributed. The specimens were composed in part of a *Meyenia* and in part of a *Spongilla*. The *Meyenia* was new, and he proposed for it the name of *M. acuminata.* He believed that a sponge is usually the product of many statospheres, and that hybridism was, from the manner of germination of the statospheres, probably of frequent occurrence. The speaker stated that he had never yet been able to detect the ciliated chambers that have been described in sponges.

Dr. Parker stated that the effect of colloids upon crystalline substances was to retard growth except in the direction of the axes. He believed that the various forms of spicules were caused by this retarding influence of the sarcode, acting with greater or lesser intensity.

Mr. Potts stated that in all spicules of sponges there was an axial space, branching towards the spines; moreover, the larger spicules can be seen to be formed of a series of annular layers.

New York Academy of Sciences, April 10.—Mr. F. J. G. Wiechmann read a paper on the fusion-structures in meteorites (illustrated with microscopic sections).

April 24.—Professor J. J. Stevenson read a paper on the economic importance of the mineral resources of Southwest Virginia.

May 1.—Dr. B. N. Martin read a memorial notice of the life and works of the late Professor John W. Draper.

May 8th.—Professor H. Le R. Fairchild lectured on the methods of animal locomotion.

May 22.—Dr. A. A. Julien presented notes and observations made during a recent visit to the islands of Curaçoa, Buen Ayre and Aruba, W. I. Mr. J. C. Russell read a paper on sulphur deposits in Utah and Nevada.

June 5.—Dr. W. Miller, read a paper on the prevention of tubercular disease in men and animals by Vaccination. Mr. N. L. Britton remarked on a glacial "pot-hole" near Williams Bridge, N. Y.

Boston Society of Natural History, General Meeting, April 19.—Mr. Frederic Gardiner, Jr., described the methods of propagating salmon, and Dr. W. S. Bigelow spoke on the study of Bacteria and allied forms.

Annual Meeting, May 3.—The curator, secretary and treasurer presented their annual reports on the condition and work of the society during the past year. The officers for 1882–83 were elected, after which the discussion of the general question of glacial erosion suggested by recent communications on the formation of lake basins was opened with a paper by Mr. W. M. Davis.

Mr. S. H. Scudder spoke of an interesting discovery of older fossil insects west of the Mississippi.

Geographical Society of the Pacific, San Francisco, March 29.—The secretary read a letter from the president of the Board of Trade, requesting the Geographical Society to discuss the merits of the Nicaragua Interocean canal The following gentlemen were appointed a committee to act thereon: Captain Oliver Eldridge, Andrew McFarlane Davis, William Aldrich, B. B. Redding and Thomas E. Slevin. A paper entitled "Memoir on the River and Harbor of Guayaquil," was then read by Thomas E. Slevin, LL.D. The president gave notice that a paper would be read at the next meeting by B. B. Redding on the Gallapagos islands.

American Geographical Society, April 13.—The president, Chief Justice C. P. Daly, delivered an address upon Spain, Straits of Gibraltar and Tangiers in 1881.

Middlesex Institute, March 14 and 21.—Mr. R. Frohock delivered the third and fourth lectures of the course on the "Morphology of Leaves," and the "Arrangement of leaves on the stem."

March 28 and April 4.—Mr. F. S. Collins lectured on the "Arrangement of flowers," and the "Morphology of the flower; calyx and corolla."

April 11.—Mrs. A. J. Dolbear explained the "Morphology of stamens and pistils" and "Æstivation."

April 12, Regular Monthly Meeting.—Informal remarks were made by President Dame and others. Resolutions of respect to the memory of Professor Thomas P. James were read, ordered to be placed on record, and a copy to be sent to the family of the honored deceased. A committee on floral exhibitions for the current year was appointrd, and the executive committee instructed to arrange with the Essex Institute for a joint field excursion in the Middlesex fells in June.

Biological Society of Washington, May 26th.—The following communications were made:—Exhibition of Eskimo carvings of animals by E. W. Nelson. Appeal for an exploration of the molluscan Fauna of the District of Columbia by Wm. H. Dall. Exhibition of a rare Arctic bird, the Spoonbilled Sandpiper (*Eurynorhynchus pygmæus*), by T. H. Bean, M. D. Air sacks of vertebrates, by R. M. Shufeldt, M. D. About mules, by Professor M. G. Ellzey.

Appalachian Mountain Club, May 12.— The report of Mr. J. B. Henck, Jr., the delegate of the Club to the Alpine Congress, held at Milan last summer, was read.

Mr. W. M. Davis read a paper on the little mountains east of the Catskills.

A paper by Henry L. Stearns, entitled "An Ascent of Pike's Peak," was read.